Gardeners and Herbicides

Gardeners who imagined controlling pests and weeds where their vegetables, fruits and decorative plants could flourish without competition or attack have long been able to turn to chemicals and branded chemical products. We saw in Chapter , Table that gardeners could use household chemicals already at their disposal, such as washing soda and caustic soda, in the garden. Gardening magazines brimmed with adverts for branded preparations to assist the gardener, although these dwindled in favour of objects to decorate and furnish the garden. Nevertheless, tool-sheds of chemical-minded gardeners were described as looking like laboratories with their rows of bottles, tins, powders and liquids.[[1]](#footnote-1) By the late 1970s there were over 200 branded chemical preparations available for amateur use in the domestic garden, along with their own consumer-focussed regulatory system, implemented by MAFF. In this chapter I examine only a small selection of these chemicals and products, with case studies being made of lawn sand (sulphate of ammonia), sodium chlorate and paraquat.

Although annual expenditure on garden chemicals by British gardeners suggests that weeds are of less concern than insect or fungal pests,[[2]](#footnote-2) I have chosen to focus on three herbicides in this chapter. While there are certainly fascinating stories to be told about the control of insects and fungi using chemicals, concentrating on the practices of weeding which are characterised as back-breaking and tedious allows me to consider the concept of labour, a theme which runs through the other chapters of this thesis. Herbicides are also implicated in more acute poisonings than other pesticides, presenting a real source of immediate hazard to the user and others who share the garden. This risk makes herbicides useful to the question of domestic users' relationship to chemicals, and in what was special about it. Gardening requires thinking about the future, and in using weedkillers gardeners must consider how they wish to use the space occupied by the weed, and the residue left on treated fruits or vegetables. In that sense, chemicals in the garden might be expected to connect the user more strongly to consequences beyond their own immediate physical health, which makes gardening different to cleaning indoors or processing photographs.

Three different weeding scenarios form the basis of decisions to use either lawn sand, sodium chlorate or paraquat, these being respectively removing weeds from lawns, paths and cultivated beds. Not only are these three chemicals used for different purposes, they allow comparison between entering the market at different periods of time; sulphate of ammonia was already an established treatment when sodium chlorate arrived on the market in the 1930s, and paraquat in the 1960s respectively. All three chemicals were initially used agriculturally before being available to domestic users, either in the same or a significantly domesticated form. Both sulphate of ammonia and lawn sand continued to be available throughout the time period that this thesis covers (even to the present day). Sodium chlorate was embraced for its long term suppression of weeds and was always referred to by its chemical name whether or not it was also associated with a brand. Paraquat "starred" as the active ingredient in branded products from a very limited number of manufacturers (but all subsidiaries of a single company), and the chemical name paraquat dominated discussions of the products, rather than its brand names Gramoxone for professionals and Weedol for home gardeners. Misuses of sodium chlorate and paraquat led to both these chemicals facing restrictions on sale, before further concerns about safety led to total bans which occurred outside the scope of this study.

The increased availability of chemical aids to gardening must be considered in the context of who worked in the home and of how leisure was pursued at home, as well as the capability of the chemical industry to provide new chemicals and convince people of their utilities. When these factors are taken into account, as this chapter aims to, we can start to understand the position of the chemical user as an active, decision-making agent operating amongst social factors including changes in availability, affordability or acceptance of chemicals, of buying-in garden care services, life cycle or recreational approaches to garden care duties. The use of gardens between the 1930s and the 1980s changed, increasingly becoming designed and used as outdoor rooms, with patios for alfresco dining, safe places for children and pets to play and for families to relax in an easy to maintain, aesthetically pleasing space. Yet gardens have remained functional, as a place to grow food for the family, a place to dry the washing. Gardens might incorporate paths that served to avoid tracking mud into the house when visiting washing lines or sheds, and so needed to be kept free of weeds and slimy, slippery algae. Even as more homes acquired automatic laundry dryers, clothes lines were not totally abandoned and in appropriate weather laundry was hung out in gardens, though perhaps on more technologically advanced carousels or using synthetic lines and pegs. Plants could be seen as a nuisance not only in the form of weeds, aesthetically displeasing plants out of place or competing with desired plants, but also a threat to neatly laid paving of parking areas, paths or patios, to building foundations or structural walls by upheaval of roots or prying tendrils. Weeding is bound up in ideas of control and power over one's domain, with weeds and other pests portrayed as enemies to be constantly battled into submission through sustained labour and chemical applications. In this way, the supposed peace and security of a domestic garden is transformed into the site of outright violence, at least in texts about weeding although in advertising herbicides this is generally not the case.

Hand weeding had long been framed in adverts for weed killers as expensive, in 1891 an advert claimed the chemicals "saves twice its cost in labour" though products advertised in the 1930s did not relate the cost of labour so directly or precisely to the cost of weedkiller, instead referring to weeding as "troublesome and expensive", or "costly and backaching".[[3]](#footnote-3) These adverts depict the effort of weeding as unpleasant, uncomfortable and inconvenient but weeding as expensive also hints that this work was paid for. While the practices of hired help inside the house have been dissected,[[4]](#footnote-4) gardening has not received the same attention, possibly because it was often carried out by the householders themselves. Historian Steven Constantine's view of middle-class gardening was that magazines for amateurs promoted gardening as a predominantly do-it-yourself activity from the 1850s, and that gardening was taken up as a gently active, restorative past-time.[[5]](#footnote-5) Even operating garden equipment could be pleasurable, as demonstrated by this statement: "What can be more tonal than the satisfaction which the grown up amateur or master of the house, enjoys when he returns from the city to his garden in the summer evenings, and applies the syringe to his wall trees, with refreshing enjoyment to himself and the plants and to the delight of his children who may be watching his operations."[[6]](#footnote-6) Although the author of this scene did not mention what was contained within the sprayer, it could have simply been water to refresh the leaves in an industrially polluted area, the possibility of fascinating picture of domestic chemical use in 1838 as entertainment, not just care of plants, has been conjured up. It suggests that children were not allowed to handle equipment or chemicals, similarly to children's access to chemicals inside the house as we saw in Chapter x. There are exceptions though, as children were specifically targeted as chemical buyers when fertiliser manufacturers made gift sets priced for pocket money[[7]](#footnote-7) as well as the fact that in the privacy of ones home, advice to keep children and chemicals separate is only advice.

Ideas of "satisfaction" and "delight" represent caring for the garden with chemicals as relaxation and entertainment, although these were not images used in weedkiller advertisement or other discussions of their use, which stuck to the themes of expense in terms of time, cost and physical effort. Using garden pesticides could also be portrayed as patriotic duty especially with regard to protecting food crops during wartime. When diarist and physiotherapist Joan Strange recorded on 5th July 1943 "dusted my greens well to prevent the ravages of the flea beetle" it was significant because it is the only reference to chemical aids among many entries which described working on her allotments.[[8]](#footnote-8) Strange was a rare case amongst amateur gardeners, who in their diaries tended to not reflect the urgency for chemical protection presented *Dig for Victory* leaflets, Ministry of Food exhibitions and short films depicted the 'Blitz on Bugs', which called on gardeners to tackle pests, prevent weeds taking nutrients needed by fruits and vegetables and prevent pests spoiling the harvest.[[9]](#footnote-9) This discrepancy between the prominence of chemicals in promotional material, on the pages of magazines or newspapers and in gardeners own words has been a constant thread during this research, and highlights how important it is to consider a range of sources before assigning importance based primarily on how frequently something was presented.

Once the deprivations of war were over, there was less need to draw on patriotism to protect the garden. That is not to say that the language or imagery of protection was abandoned, but gardening as leisure rather than duty could be prioritised. Chemicals could even shape the design and structure of gardens when designers considered easier herbicide application as part of a labour saving garden, and made paths that could be treated without the weedkiller spreading or leaching to non-target areas.[[10]](#footnote-10) These everyday interactions demonstrate that garden chemical users made sophisticated decisions, calculating how their leisure time could and should be spent, and that they were very much the controlling force in the relationship between user and chemical.

However, the range of chemicals available to domestic gardeners was limited by the Pharmacy and Poisons Act 1933, and the Poisons Rules, which we encountered earlier in the chapter on household chemicals. It exerted its influence on retailers who had to be registered to sell products included on the list, then discern who could properly buy the poison and record their details if necessary, but as with household chemicals the legislation also shaped the products that were sold as manufacturers searched for products that could be sold as widely as possible.[[11]](#footnote-11)

Acids were mentioned earlier as a form of herbicide that became restricted through the Poisons List, but another type of chemical on this list were the arsenical compounds, which were still available to domestic gardeners into the 1980s. Their use was not widely recommended in the pages of gardening advice and other less poisonous products readily displaced them, such as sodium chlorate. Gardeners who wanted to use arsenic preparations such as Paris Green to kill pests were advised to seek out named brands of pastes, safer to handle than the powdered forms.[[12]](#footnote-12) However, arsenic based domestic products had not been taken up with particular gusto, despite their effectiveness. The early implementation of maximum arsenic residue levels on agriculturally produced food crops which would have raised the profile of risks associated with domestic spraying.[[13]](#footnote-13) Additionally, their association with accidental or deliberate poisoning, made gardeners wary of arsenic products. Indeed, poisoning with arsenical weedkiller was a staple of Agatha Christie novels,[[14]](#footnote-14) cementing this domestic use of chemicals into the popular imagination.

In the 1930s it could be quite difficult to know what exactly you were getting when you chose a branded herbicide, there was no obligation for manufacturers to display the active chemicals. Corry's Weed-Death, Bentley's Mortweed proclaimed that they were nonpoisonous, but did that mean that Tomlinson and Hayward's Eureka which omitted this detail, was poisonous? How did they work if they were not poisonous, at least to plants if not people? There was a considerable degree of mystery and concealment with these preparations but if gardeners were complaining about this, they were not writing it in places that could be found and no editors published letters asking for change, though this is not surprising if they felt dutiful towards their advertisers.

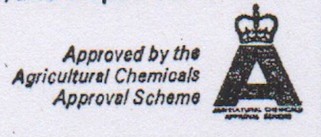
This lack of information for users and absence of structured regulation continued until 1957. For the purposes of this chapter, this means that lawn sand and sodium chlorate were not in any way vetted or formally approved before domestic gardeners began using them in their homes. However, paraquat was subject to this new era of regulation. Agrochemicals were of interest, an investigation by the Committee on Toxic Substances in Consumer Goods which specifically looked at new chemical products had been followed by cluster of deaths among farm workers associated with pesticide application between 1946 and 1950, plus agrochemicals had been linked to large scale, discernible and widely discussed wildlife deaths, a topic that has traditionally worried the British public at least as much as human deaths.[[15]](#footnote-15) [[16]](#footnote-16) As many of the garden chemicals used at home were the same as, or closely related to products used in large scale agriculture, the formation of a regulatory scheme to ensure the safe use of agrochemicals was also applicable to domestic users. The case study on paraquat will look at this in greater detail.

The voluntary, industry-regulated Pesticides Safety Precautionary Scheme (PSPS) was set up in 1957 and operated in close contact with the Ministry of Agriculture, Food and Fisheries (MAFF), as a way of avoiding the potential inflexibility of full legislative measures. The Advisory Committee on Poisonous Substances Used in Agriculture and Food Storage, which was later renamed the Advisory Committee on Pesticides and Other Toxic Chemicals (generally referred to as the Pesticides Advisory Committee), as well as the Poisons Board examined then discussed technical reports and proposals with company spokesmen. The committees were composed of experts in branches of toxicology, practiced in examining technical, scientific documents and thinking about risks; neither professional or domestic chemical users were represented on these assessment committees or their input sought, instead they were simply imagined. It is interesting that a scheme initiated in response to increasing awareness of consumer rights and consumer power, did not involve consumer groups or union representatives. This situation was not challenged until the 1980s, when unionised forestry and agriculture workers publicly questioned the continued use of the herbicide 2,4,5-T, notorious for its use as a defoliant in Vietnam and method of manufacture meaning that some brands were contaminated with dioxin, which was implicated in severe birth defects and incriminated all 2,4,5-T preparations by association. The absence of users via union representation earned the criticism that committee was an "amateurish body of academics and civil servants",[[17]](#footnote-17) in the view of the union an expert committee must contain the experts in use not just effects or mechanisms of action. Continued action by unions, and evidently no obvious change in the committee composition prompted MP (Berwick and East Lothian) John Robertson to demand agricultural industry workers, along with Health and Safety Executive be represented on the pesticides advisory committee.[[18]](#footnote-18)

The poor representation of the users through the makeup of the committee led MP (Yeovil) Paddy Ashdown to complain in 1985 that of the five medical doctors on the committee none were concerned with living patients,[[19]](#footnote-19) i.e. those who may use, misuse or be otherwise exposed to the chemicals examined by the committee. Ashdown's contempt for academic "rat-doctors" and his distaste for pathologists indicates where improvements in communicating about the regulatory processes could have been made, but these arguments raised the point of whether these laboratory or desk-based men, as they were men, could really stand in for the whole range of domestic and professional users. By gathering experts to deal with technical material, the committee could work relatively fast, and allowed a pragmatic and flexible case by case approach. An average gardener would have required more extensive support and time to understand the issues, but the experts could also have been be amateur gardeners and so drawn on their experiences.

Assessments of the safety of chemicals were based on a limited number toxicological observations of test animals: observations of skin and eye exposures, feeding tests and getting a sense of acute toxicity of a chemical through the application of lethal dose 50 tests. As the name implies, the PSPS dealt purely with safety factors, rather than the effectiveness of any product, but a programme that covered efficacy had already been in operation for around 15 years, and became formally recognised as the complementary system to PSPS when it was renamed the Agricultural Chemicals Approval Scheme (ACAS).[[20]](#footnote-20) Efficacy had been prioritised over safety, but following the scrutiny of agricultural chemicals instigated after deaths of workers, this situation was reversed. The formal recommendation to take safety more seriously meant that new chemicals had to pass scrutiny by PSPS before their efficacy could be considered by ACAS.

The impact of this scheme on domestic users was that they were told that they could feel reassured that the new chemicals arriving on the market could be relied on to be safe (when the carefully worded precautions were followed) and effective. Garden chemical users were encouraged, through the government booklet *Chemicals for the Gardener* and via gardening magazines which picked up public relations material from the Association of British Manufacturers of Agricultural Chemicals (ABMAC),[[21]](#footnote-21) later renamed British Agrochemicals Association (BAA)*,* to look out for the 'A' symbol granted to products that had successfully been approved (Illustration). Manufacturers duly included this in product advertisements and packaging. Some of the processes behind approval and what could be expected of products with the Approved logo were also explained in readily available publications, including those from the Consumers Association.[[22]](#footnote-22)

Illustration 1: The clearly recognisable logo of a crown-topped letter A, denoting that a product had been approved.

The *Chemicals for the Gardener* booklet also took care to emphasise the importance of following the safety instructions given by the manufacturer on the label, because these too had been approved.[[23]](#footnote-23) The warnings and instructions for use were scrutinised as part of the PSPS process because appropriate information reduces the likelihood of accidents, although words on a label or box cannot compel the user to follow them. This was an issue that those in the chemical industry grappled with for every new product. As Eric Edson, research director of chemical company Fisons, explained on television in 1964, misuse was viewed as an "inevitable risk" for any new chemical product, including household chemicals. He made it clear that chemists were exceedingly careful to produce useful, effective products that could be used safely. Edson directed attention to the user as the cause of any problems with chemicals when he said "I bet my bottom dollar that someone is going to misuse it so much that even the safest chemical is going to cause trouble somewhere, sometime."[[24]](#footnote-24)

Despite the agrochemical industry hoping to avoid legislation by voluntarily initiating the PSPS, the British government still deemed greater protection of consumers desirable, which they sought to foster through the Farm and Garden Chemicals Act 1967. Care was taken to specifically define gardening as including the destruction of weeds in drives, paths and courtyards, meaning it was applicable to householders who perhaps did not see themselves as gardeners in the traditionally creative or nurturing sense. However, results were slow to come about due to expectations that the Act would be superseded soon after, as well as taking into account relevant legislative changes in Europe. Although the Act can be seen as a marker of the heightened awareness of chemical persistence and serious, unknown, delayed effects on environmental and human health, it does not seem to have had much impact and it was very rarely referred to in correspondence relating to the control of chemicals studied in this chapter. In contrast, the industrially run PSPS had far greater influence, suggesting that the Act was a gesture to be interpreted as the government being aware of unease among the populace about unknown chemical dangers and concerned to look as though it was taking measures to protect them, when the bulk of the action was dealt with by industrialists and by those sympathetic to them.

The Farm and Garden Act emphasised concern for users, with a clear focus on labelling, which according to the Act should include the name of the substance, a "mark, symbol or colour" to indicate any hazard to "human beings or other forms of life". This brought garden chemicals into line with pharmaceutical drugs. Where products should be labelled, anyone found to "sell, or offer or expose for sale" an unlabelled quantity of product would be committing an offence and subject to a fine.[[25]](#footnote-25) This suggests that not only did the manufacturer have to label their product appropriately, but that some retailers sold inadequately labelled, presumably re-packed or decanted garden chemicals and this was considered to be a problem rectifiable through the Act. From May 1973 all proprietary garden chemicals had to be labelled with the common chemical names of their active ingredients,[[26]](#footnote-26) though this left room for improvements including "at-a-glance toxicity marking" to be overseen by the standardised hazard labelling that the European Council made compulsory in 1985, which ultimately commanded more influence than this Act. That gardeners had been navigating their way through products and chemicals that were not necessarily labelled fully on their packaging, does not necessarily mean that they were ignorant or ill informed, as they had been able to glean this information from other places. Although it now took less effort to get this information, there was not an outpouring of joy or relief at this fact in the media or in private diaries, and neither was there any sudden marked improvement in domestic gardeners being able to more effectively or safely use the chemicals.

The users themselves wanted clear, informative labelling on garden chemical's packaging, but this desire for was not considered met, generally due to the small print necessitated by the size of the product. This can be seen by solutions improvised by frustrated gardeners and shared in magazines such as *Practical Gardening*. In the following examples, user unfriendly labelling was addressed by attaching larger labels (Illustration)[[27]](#footnote-27) or creating ready reference dosage charts for their selection of garden chemicals (Illustration).[[28]](#footnote-28) What is striking about these examples is that the gardeners focused on personal efficiency while Government targeted safety, something generally not mentioned by the user as a problem with the labels. Safety was something that the user could take care of themselves, for instance the provision of dedicated spoons (Illustration) shows how that domestic user avoided contamination of kitchen equipment. The problems that gardeners were tried to fix were not ones that could be addressed by parliamentary acts.

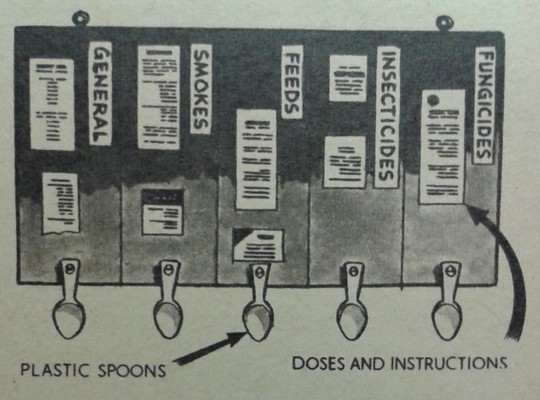
Illustration 2: A reader's suggestion to help gardeners keep appropriate equipment and instructions available for garden chemical use

Illustration 3: Reader's solution to illegibly small instructions on chemical packaging. Measures here all use container caps.

These illustrations show a level of dissatisfaction among amateur garden chemical users. They put up with problems, but they also tried to solve them where they could, behaviours which did not reveal themselves in the household chemicals chapter. Household chemicals had not been subject to the same level of industry regulation, having apparently fallen through a gap or been assumed to be less capable of being used harmfully. Now I will move on to the first of three case studies, ammonium sulphate, one of the active ingredients in lawnsand.

## Ammonium sulphate and lawn sand

Before the introduction of biologically sophisticated, hormonal, selective weedkillers onto the amateur market in the 1940s, a grand claim was made about sulphate of ammonia when it was declared "probably the most important chemical agent for weed destruction".[[29]](#footnote-29) Sulphate of ammonia was especially highly regarded for lawn care, demonstrated by the regularity that it was recommended each spring and autumn by garden correspondents as well as by testimonies of ordinary domestic users, as well as a month-long heated discussion through the letter pages about correct proportions for the desired outcome aired by a variety of professionals and amateurs.[[30]](#footnote-30) It was quite modestly heralded, it would not eradicate weeds but gardeners were more realistically promised that slow but efficient hand weeding could be supplemented with scientifically proven garden chemicals, reducing the overall long term labour.[[31]](#footnote-31)

Ammonium sulphate has been linked to the industrial age as a by-product of the coal-gas industry, which explains the timing of its appearance in agricultural and garden products in the 1870s as uses were found for this newly abundant chemical.[[32]](#footnote-32) However, it was also produced through conventional chemical manufacturers, including Imperial Chemical Industries. One of the main destinations of ammonium sulphate was agriculture, but it was for harnessed for fertilisation rather than as a herbicide. The chemical releases ammonia into the soil where it becomes available as nitrogen, which is vital for plant growth. Ammonium sulphate as a weedkiller first entered domestic gardens in the form of lawn sands in 1870, meaning that its use was very well established by the 1930s and not subject to any regulation associated with the PSPS, which was for new chemicals only. The purpose of lawn sand was two-fold, and could therefore be used in two different ways: the entire lawn could be treated, fertilising the grass and killing the broadleaved weeds at the same time, or the lawn sand could be dropped onto individual weeds to kill them.

Branded, ready mixed, convenient lawn sand made by Mr Watson, of Leeds was recommended by name as a new product in Samuel Beeton's garden book, together with information on price and where to obtain the product.[[33]](#footnote-33) Lawn sand was readily embraced by users, indicated by other companies producing competing lawn sands, which caused Watson's to proclaim their garden aid as "the only original lawn sand".[[34]](#footnote-34) Proprietary lawn sands won awards at the Royal Horticultural Society's Chelsea flower show in 1913[[35]](#footnote-35) and 1914.[[36]](#footnote-36) These awards show that over the forty years since introduction, lawn sands had gained a solid reputation among users and could be relied on to be effective.

However, it was the functionally named lawn sand, rather than the chemical ammonium sulphate or any of the other constituents, that was presented as the solution to gardeners' weed problems. For over fifty years after lawn sands' introduction, the active ingredient was considered "shrouded in mystery"[[37]](#footnote-37) to the detriment of most amateur gardeners, and explanations of how it worked were vague, and inaccurate such as "impregnated with chemicals of a caustic nature". Gardeners with enough curiosity and knowledge of experimental chemistry to work out the components of these branded mixtures could dissolve that mystery, and the proliferation of similar products suggests that some did, even if they used the knowledge to sell competing lawn sands rather than to make the ingredients in it more widely known. The "invisibility" of the chemical constituents in branded lawn sands, caused proprietors of lawn sand to be viewed with suspicion, due to their lack of explanation to consumers about how the product would work and which possibly caused users to buy much more than necessary.[[38]](#footnote-38)

In 1922 gardeners were only just being informed by the gardening press about the identity of the active component, sulphate of ammonia, and that it was mixed with sand in order to facilitate its even distribution across the lawn.[[39]](#footnote-39) This revelation, which does not appear to coincide with any recently ended patents, led to recipes for lawn sand being made available in books, magazines and newspapers. The recipes did not spell out where to obtain the chemical constituents, which suggests that gardeners were familiar with obtaining chemicals and advice on their use from hardware stores, seedsmen and chemists. By the 1930s, lawn sand recipes were ubiquitous in advice about lawns, and the basic proportions provided a template that gardeners were encouraged to adjust and personalise to their particular needs.[[40]](#footnote-40) For instance, those with mossy lawns could include iron sulphate, a slightly green tinged crystalline chemical. This personalisation could be the key to why gardeners chose to make up lawn sand themselves, as the costs of buying individual components did not always work out cheaper. On the other hand, a great deal of user confidence was required to overcome the abundance of alternative chemical names which make sense if you know about them (ferrous for iron), tied to the consequences of picking a similarly named but wrong chemical (phosphate instead of sulphate), in combination with the propensity for selling items named only in relation to their function (soil improver, worm cast preventer, moss killer) also contribute reasons for turning to ready-formulated, trusted products.[[41]](#footnote-41) Proprietary lawn sands continued to be marketed for the duration that this thesis is concerned with, indeed to the present day, as a convenient option, and notable by their absence are adverts for the chemical sulphate of ammonia alone. The continual presence of recipes indicates that amateur gardeners could seek out the chemical constituents, and the supply was not interrupted by war shortages (though its applications to lawns were) or safety concerns.

Illustration 4: An advert for Corry & Co's products, regularly seen in gardening magazines. Bottom right is Fowler's Lawn Sand. Top right Weed-Death is likely sodium chlorate.

## Using ammonium sulphate

Illustration 4 above includes Fowler's lawn sand, which advises that the smallest tin (priced at a shilling) would treat 8 to 10 square yards. The advert broadcast the slightly contradictory message, of killing weeds and moss yet fertilising grass, which was inherent in lawn sand, and the declaration that "The oldest and still by far the best. The one your grandfather used" appealed to tradition and family ties. The advert also suggested that it can be used directly on weeds, as well as spread over the whole lawn. All scales of use were catered for, with 1 cwt kegs also listed.[[42]](#footnote-42) Fisons headed their advert "fertilisers" but went on to describe killing. This advert was directed towards users who needed larger quantities, with quantities of lawn sand from 7 lbs and upwards, and advised that "one cwt would be sufficient for one tennis court and surround", but did not point out that it could be dropped on individual weeds.[[43]](#footnote-43) Although the two products were very similar, their wording as well as their placement *Amateur Gardener* and *The Times* respectively clearly aimed to reach particular segments of users who had different needs.

Advertisements like this divested responsibility of explaining the painstaking methods that gardeners ultimately used in order to get even coverage of the product to gardening magazines, and manuals which showed in great detail how to section the lawn into measured areas using string and pegs to get even coverage when distributing it by hand, a surprisingly complex and skilful practice. This process was never presented as a chore, but as necessary maintenance for a healthy lawn, and with an attitude of pride in doing a job well. Although lawn sand is not a poisonous substance, nor an irritant, hand application was perfectly safe, however to ease application of the mixture machinery to transport and distribute the mixture was invented and employed.[[44]](#footnote-44) Results from controlled experiments were publicised which showed that two autumn applications of lawn sand gave a better outcome than 38 hours of hand weeding. The message that "conscientious and intelligent application of lawn sand is one of the most satisfying ways of improving a lawn"[[45]](#footnote-45) hints that using this chemical method was not considered a cheat, but was making the most of modern technologies and knowledge.

Even for spot weeding, lawn sand did not need to be applied with any special equipment as it could be sprinkled straight from the container onto the offending weed by hand, or indeed as the Fowler's advert above suggested, pinched, or the approximate measurement being a saltspoonful.[[46]](#footnote-46) Gardeners could construct a shaker by perforating the tightly fitting lid of a tin can,[[47]](#footnote-47) or purchase a dedicated conical distributor which dropped a little of the sand onto the weed.[[48]](#footnote-48) These machines and gadgets, homemade and bought, perhaps speak more of the appeal to men of dedicated tools that can accompany and enhance the experience of gardening, rather than any necessity attributable to the chemical's properties.

Both lawn sand and sulphate of ammonia continued to be recommended and used in domestic gardens for the entire period that this thesis examines. In 1954, gardeners were reassured that although lawn sand was "old fashioned" now that so many other weedkillers were available, it was still useful[[49]](#footnote-49) and this message was reasserted in 1986 with the extra detail that there were weeds on which selective weedkillers were ineffective.[[50]](#footnote-50) This incredible longevity and continuity of domestic use shows that lawn sand and by extension ammonium sulphate, was considered by gardeners to be reliable, effective and safe. The coexistence of lawn sand and sulphate of ammonia shows that different types of domestic user, those who preferred the convenience of buying a ready mixed product when they need it, and those who preferred to make it up as required, whether for reasons of economy or tailoring to suit the conditions in an individual garden, created enough demand for both lawn sand and ammonium sulphate to be regularly retailed beyond the 1980s.

# Sodium chlorate

This is the other chemical that was readily used in the domestic garden for the entire duration that this thesis is interested in. Environmental historian Clinton Lorne Evans writing about the grasslands of Canada and North America claims that the herbicidal qualities of sodium chlorate were known from 1904, though not systematically investigated until the 1920s.[[51]](#footnote-51) The first group to market the chemical as a herbicide were Chipman Chemicals who were based in New Jersey, although for the interest of this thesis concerned with Britain they were represented here by an affiliated company, Chipman Chemical Company Ltd. From 1926, they promoted a 50:50 sodium chlorate and calcium chlorate herbicidal mixture they called Atlacide, which they rooted in reliability by letting it be known it was powdered form of an older product line of theirs, the famous Atlas nonpoisonous weedkiller, although Atlas was not a name that cropped up in my perusals of British gardening magazines. Chipman ran a campaign targeting American farmers, but did not sustain it and an equivalent British campaign has not been found so far.[[52]](#footnote-52) Chipman's biggest customers were railway companies, who were anxious to stop weeds from clogging up the rails or undermining their infrastructure.[[53]](#footnote-53) It was not until the 1930s that sodium chlorate was used on an industrial scale by farmers for clearing land of ragwort, a plant poisonous to cattle, sheep, horses and pigs, as part of pasture renovation. British newspapers which reported on farming matters publicised reports of this development, but there was little actual advertising of sodium chlorate as a herbicide.

Domestic use followed industrial and gardening manuals, magazines and newspaper gardening advice columns began to recommend sodium chlorate for killing isolated weeds in at home but not where it could be obtained from, any proprietary names or more detail about how best to use it. The longevity of sodium chlorate's effect meant it was singled out as particularly effective for clearing weeds from paths, drives and other areas that could perhaps be described as hard landscaping, that the user intentionally wanted to keep barren. The strength of this effect was balanced by the promise of its non-poisonous nature, as under normal circumstances of use it was not poisonous to gardeners or other garden users. This lead it to be quickly seized on as a harmless alternative to arsenical weed-killers "of evil repute".[[54]](#footnote-54) Although Table 1 shows that acute poisoning with sodium chlorate was possible and had unique forensic characteristics, the concept of being non-poisonous was an aspect that companies were particularly keen to promote. British Chipman representative T.H. Thatcher swiftly corrected *The Times* journalist who described the chemical used by Southern Railways as a poison, delivering a lesson on sodium chlorate's benefits in his published letter to the editor.[[55]](#footnote-55) Chipman did not attempt to reach domestic users by advertising at this time, and a more holistic approach to sodium chlorate promotion was taken by the National Allotment Society (NAS). Through a series of articles from 1934 which encouraged members to keep their plots tidy, they boosted sodium chlorate as the answer to weedy paths and unkempt areas.[[56]](#footnote-56) As a result, the organisation claimed to have received requests for more information about this wonderful weedkiller and letters from disappointed gardeners unable to obtain it.[[57]](#footnote-57) Having apparently generated a demand for the chemical, they became suppliers. In 1935 NAS arranged for sodium chlorate to be packaged in quantities appropriate for domestic use, which they made available through their existing seed and equipment business, National Horticultural Supplies.[[58]](#footnote-58)

The discussion in the NAS journal referred to the 'foreign product'[[59]](#footnote-59) suggesting that it was imported to Britain. This fits with historian Peter Reed's study of the United Alkali Company (UAC), who described sodium chlorate's UK production as closely linked to explosive manufacture during World War One. When the demand decreased after the war, UAC closed many of their plants[[60]](#footnote-60).[[61]](#footnote-61) This left Albright & Wilson's (A&W) Oldbury Electro-Chemical Company hydro-powered plant based at Niagara Falls the dominant producer of sodium chlorate globally.[[62]](#footnote-62) Britain's lack of a sodium chlorate manufacturing plant was addressed by Staveley's Coal and Iron Company in 1935 and indicates that the market for sodium chlorate as a herbicide had grown quickly and shown itself to be lucrative, bearing in mind that only three years earlier the idea of using sodium chlorate agriculturally was novel. It took them several years to get the plant operational and they did not appear to market directly to users.[[63]](#footnote-63)

Illustration 5: A worker sprays herbicide at the tracks from a Chipman Chemical Co Ltd carriage in 1955. Chipman provided 2,4-D and DDT as well as Atlacide. The absence of information about the herbicide likely reflects the interests of the collector/photographer towards locomotives. © National Railway Museum and SSPL

As well as being a very effective and long lasting weedkiller, people who used sodium chlorate faced a very specific risk of accidental fires and accidents which had claimed lives since its introduction as an agricultural herbicide,[[64]](#footnote-64) so NAS explained how to manage this hazard. Gardeners were advised to rinse any chlorate impregnated items in clean water, an easily followed and common sense instruction which readily reduced and made acceptable the fire risk.[[65]](#footnote-65) NAS did not mention Chipman's branded product, Atlacide, that incorporated a fire depressant making it far safer option. Although it is tempting to link the spread of domestic sodium chlorate use to railways and allotments, as many allotments were on land owned by and overseen by railway companies who could influence NAS, if this was the case maybe they would have influenced NAS to use the same product that the rail companies used, Atlacide. Sodium chlorate alone could have been a more economical option, rather than what large companies could afford, with easily taken precautions which balanced out the risk inherent in using this lower priced chemical.

Until NAS acted as an intermediary, dealing with industrial quantities and bulk importers on domestic users behalf, sodium chlorate either as Atlacide or any other preparation was apparently inaccessible to home gardeners. However, by 1939 Plant Protection had taken on the distribution of sodium chlorate to domestic users, placing small adverts in the *Times* every couple of days between March and June to raise the profile of the "safe chlorate" that could be used to "Dust away weeds from garden paths, hard tennis courts and c." Atlacide came in sprinkler topped tins in 3 different (but undisclosed) sizes accordingly priced at 1/6, 2/9, and 4/6 from ironmongers and seedsmen.[[66]](#footnote-66) Boots, who called themselves "The Gardeners Chemist" swiftly followed suit.[[67]](#footnote-67) Boots' sodium chlorate was sold under the plain chemical name, packaged in tins priced at 10½ d for 1lb, or 14 shillings for a 20 lb tin. This made the pure sodium chlorate considerably less expensive than the Atlacide, lending credence to the idea that suppliers like NAS and Boots had decided to make the weedkiller available to gardeners without the fire suppressant in order to reduce prices and appear more attractive to the consumer, who could easily take the precaution of rinsing out any saturated items. Even when packaged under other brand names, such as "Eureka" sodium chlorate from Tomlinson & Haward Ltd[[68]](#footnote-68) (apparently still keen to capitalise on their well known Eureka brand, previously based on arsenic although now clearly identifying the active chemical as sodium chlorate), it did not lose its true chemical identity, as sodium chlorate remained prominently on the label.

The sprinkler topped tins of Atlacide and the large tins from Boots indicate that gardeners could choose between brands depending on how they used the weedkiller, as well as the price or risk of fire. Within the containers were crystals like salt, which could be sprinkled directly out of the tin onto weeds or applied by hand, or the chlorate was dissolved in water before application. Gardeners were free to make up a solution to their desired strength using the solid forms, and could dilute the liquid forms to weaker concentrations. Different concentrations of sodium chlorate solution were used to kill different types of weeds; stubborn deep rooted weeds were given the strongest treatment while smaller annual or biennial weeds could be done away with a weaker solution.[[69]](#footnote-69) This gave an apparently crude, total and unselective herbicide a degree of subtlety and allowed the gardener freedom to exercise their judgement in determining what would best suit their particular situation. Once sodium chlorate was accepted by gardeners, manufacturers offered it in other convenient forms, such as a powder that was easier to dissolve, or even a liquid concentrate. The 1981 advert for Cooke's sodium chlorate highlights a liquid form. The following two adverts are typical of those for sodium chlorate, which appeared among the small adverts rather than a whole page.

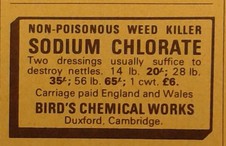
Illustration 7: Advert from 1966, Practical Gardening magazine

Illustration 6: Advert from 1981, Practical Gardening magazine

Sodium chlorate was clearly the chemical that was being sold to gardeners, although each chemical company imprinted their own name on the product. These manufacturing companies were also retailers and Bird's highlighted the non-poisonous nature of the chemical, whereas the Cooke's advert did not. No users were shown in the Bird's advert, while the Cooke's advert showed a man using a watering can, which we presume to contain a solution of sodium chlorate. Potential users were invited to imagine clearing weeds from drives, paths and wasteland in addition to the pictured patio. No information about how long the user could expect the sodium chlorate to last is given, but the listed scenarios do not include any that suggest to the user that they would be growing anything there for a while. The addition to Cooke's product of fire depressants was stressed, as was the chemical's effectiveness and inability to harm the environment. This concern for the environment is particularly typical of advertisements from the 1980s, when this angle was seen as one that could attract users concerned about this issue.

What we do not see in these advertisements is the crowned "A" symbol which would communicate that it has been approved by the PSPS. Indeed, there was no need as these producers were not selling a new chemical, but a relatively simple, well established product: solid crystals or powder, rather than with additives other than fire suppressant which had been incorporated since the 1930s. Large producers, such as ICI and Syngenta, were able to afford to put their sodium chlorate preparations through the approval system, whereas the adverts shown here are from small companies for whom financing this operation would have been prohibitive. Consumers were navigating a fairly complex landscape of chemicals and assurances, but here the identity of the chemical was all they really required.

Occasionally an incident where someone had been burned by a fire involving sodium chlorate appeared in the letters section of a British medical journal, or newspaper, apparently not warranting the attention given by a full article. The only exception to this was when a baby was hurt which made the national news, although the article was so brief that it is hard to tell what happened or what the outcome was.[[70]](#footnote-70) No reference to previous or foreign accidents was given in these accounts of fires, but neither did they carry the full outrage of some danger newly discovered, instead reading as if the information about this risk to the user were indeed quite readily available. This danger of fire was deemed preferable to the danger of poisoning by arsenical weedkillers, and the unpleasant handling qualities of tar-based compounds, which explained the popularity of sodium chlorate among amateur gardeners for weed clearance.[[71]](#footnote-71)

When EC regulations came into effect in 1985 which meant chemical packaging had to carry standardised warning symbols, sodium chlorate would bear the icon for oxidising. While it was the chemically correct description of sodium chlorate's fire starting properties, the chemical had always been described to domestic users as inflammable, and it would continue to be so in magazines and books. This discrepancy seems to have passed without public comment, perhaps indicating that gardeners did not mind about this pedantry, so long as they could still purchase and use the chemical when they wanted it. Both symbols represent fire, so even if a user did not fully understand the difference, they were able get the gist of the warning.

Illustration 8: The oxidising symbol, the chemically correct description of sodium chlorate's reactivity.

Illustration 9: The flammable symbol, not used for sodium chlorate, despite this being how the chemical was usually described among and to amateur gardeners.

The risk highlighted to gardeners far more frequently than accidental fires was sodium chlorate's propensity to seep or creep into non-target areas and kill or damage non-weeds. To reduce this possibility, gardeners were urged to consider the likely future weather conditions as well as weighing up the plants that might come into range if rain caused the weedkiller to spread further.[[72]](#footnote-72) Labour-saving garden designs took into account how easily weedkiller could be applied to paths without harming nearby plants, trees or lawns.[[73]](#footnote-73) The exhortations in newspaper gardening columns to consider sodium chlorate creep incorporated the reminder that neighbours' plants were at risk and show that accidental damage was a distinct possibility, but the use of the herbicide to deliberately damage a person's property does not appear to have been a large problem. Gardeners were shocked when a vandal targeted multiple gardens of a village,[[74]](#footnote-74) but sports facilities rather than domestic gardens were the most high profile instances of unsolicited weedkiller use.[[75]](#footnote-75)

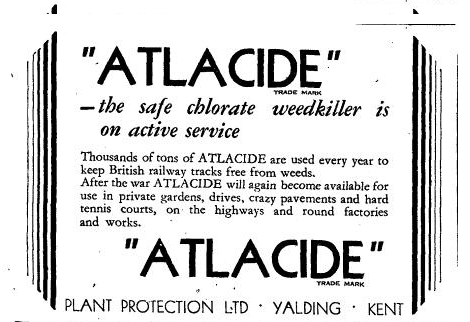
While vandalism using weedkillers was not something that manufacturers could address, creep and fire risks were undesirable features that could be highlighted by manufacturers and marketers to set their new products apart from sodium chlorate. By 1964, simazine-based products were recommended as preferable to sodium chlorate because they did not creep, nor were associated with fires, and their effects were even longer lasting than sodium chlorate. As simazine could last years in the soil, it usurped sodium chlorate's status as the chemical that could give the longest period of effectiveness, and redefined it as a medium-term weed suppressant. Nevertheless, sodium chlorate continued to be recommended and used when a relatively cheap and reliable long term weedkiller was needed.

## Misuses

Although the oxidising properties of sodium chlorate was not a principal concern to gardeners, they were at different times and for different reasons a preoccupation of various governments. Sodium chlorate was included in the "Prohibited Chemicals" list,[[76]](#footnote-76) a selection of chemicals compiled by MI5 in 1939 believed to be desirable to those who wished to damage national security. Homemade bombs were later the subject of concerned correspondence in 1941 when a German agent was found to be carrying instructions to go to chemists shops and purchase bomb making chemicals, including sodium chlorate. This validated the list, but it was hypothesised that while chemists may consider selling 28lb of these bulk chemicals specified in the instructions, a would-be bomb maker would not purchase supplies from a single store, to avoid arousing suspicion.[[77]](#footnote-77) Nor were chemicals only in their pure form subject to this, demonstrated by an incident in 1942 where schoolboys made pipe bombs from scrap metal, flowers of sulphur and throat sweets which contained potassium chlorate. It was deemed not to be a threat to the system, as the chemist should not sell more than a pound of potentially explosive material.[[78]](#footnote-78) Another route of access to these restricted chemicals pondered by officials was that would-be bombers would join horticultural or co-operative societies, both of which had been identified as potentially distributing chemicals to unrecorded people.[[79]](#footnote-79) This circularity, as we saw the role of allotment societies in informing and enabling access to the chemical, is striking.

Sodium chlorate's availability to legitimate gardeners should have been uncomplicated despite these measures, although subject to the whims of the retailer. Sodium chlorate's place on the prohibited items list did not meant that it could not be sold at all, but that the sale should be recorded for monitoring purposes. One pound of sodium chlorate was all that a person could buy at any one time, unless they had a police certificate. One pound made a gallon of strong, 10% solution for treating deep rooted weeds, or four gallons of 2.5% solution for smaller annual weeds, so this restriction should not have affected most domestic gardeners. The retailer had to fill out a lengthy form declaring that the buyer was known to them and the quantity sold, then return it to be centrally processed. Being asked for an ID card, an address and the reason for the purchase may have been a deterrent to a customer, but the process proved mainly to discourage the vendor. Suttons Seeds worried that they could not properly describe their customers as "known" to them and complained that the number of purchasers of chlorates and nitrates during spring would require an extra clerk to process all the paperwork. While most retailers did endeavour to go through this time consuming process and lots of forms were received in the first year of implementing the scheme, the urgency and enthusiasm for this national duty waned, shown by the tailing off of reporting. Some chemists continued to sell the chemical without reporting, while others preferred not to sell prohibited chemicals at all, as they did not like the bother of dealing with the paperwork.[[80]](#footnote-80)

These measures were not widely communicated among the general public, at least not through mainstream media, and only appropriate retailers were issued with the list of prohibited substances. There had been concern about whether the concept of sabotage should even be included in how the list was titled, fearing that it could inspire this type of misuse. Neither the list, nor any evidence of its implementation, was discussed in gardening magazines or in newspapers, suggesting that gardeners on the whole did not encounter any changes in the supply of their new favourite herbicide that were serious enough to complain or comment about. By 1943, the threat level was declared lowered, and the reporting procedure was lifted on sodium chlorate and most of the other chemicals on the list. Plant Protection Limited's wartime reassurance to their customers (see Illustration) that "Atlacide – the safe chlorate weedkiller is on active service".[[81]](#footnote-81) Atlacide, as we saw earlier, was Chipman Chemical's formulation to include a fire depressant so, but if domestic users understood that the reason that sodium chlorate supplies in general were restricted or reduced because for the good of the country, then they would be less likely to complain about this patriotic sacrifice. However, the trouble of inadequate sodium chlorate supplies for use in agriculture was regularly raised in Parliament between 1944 and 1948.[[82]](#footnote-82)

Illustration 10: Advert placed to inform domestic users about the disappearance of this brand from the general marketplace indicates that sodium chlorate was in restricted supply.

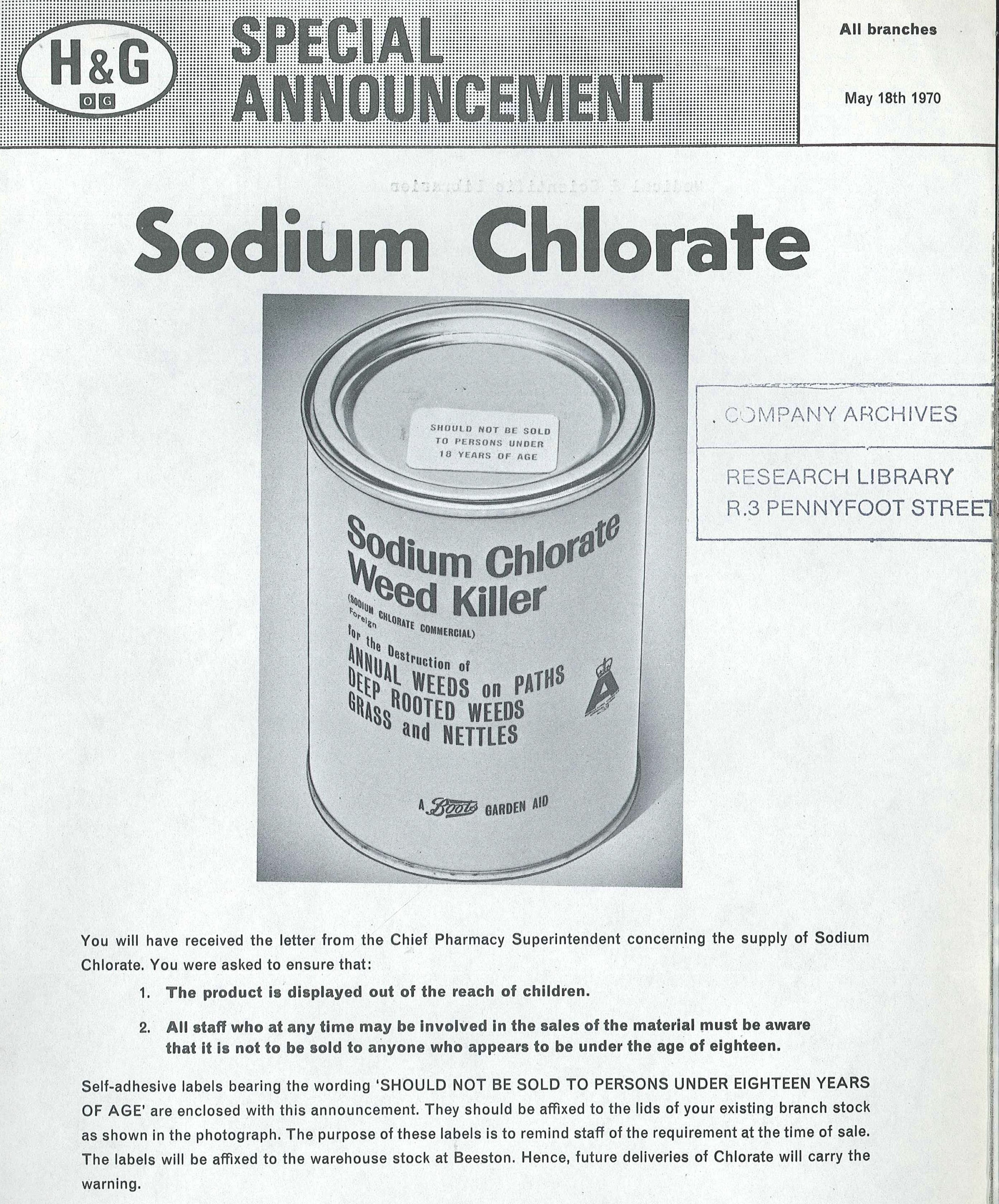
With the threat of war over, entertainment motivated schoolboys to employ sodium chlorate's oxidising nature in homemade fireworks and bangers, and the focus of government officials switched from sabotage to child safety, albeit with a post-war lapse of interest in the chemical altogether. Accidents most often occurred during transport of the bangers in a pocket, where the friction caused by walking or running resulted in premature ignition and detonation. Between 1956 and 1966, 242 young people had been injured by homemade explosives containing sodium chlorate.[[83]](#footnote-83) Garden writers called for "serious investigation" into why such a potentially dangerous chemical could be bought in brown paper bags from any hardware shop or chemist without any warnings,[[84]](#footnote-84) but they themselves had rarely noted that the chemical should be handled with care by gardeners and did not cease to recommend its use as a herbicide. This shows an inherent, and unaddressed distinction about in whose hands a chemical became dangerous. In an adult gardener's hands, sodium chlorate was only a danger to plants, but in a child's hands the chemical became a danger to their intact body.

These accidents involving young banger makers initiated a flurry of parliamentary activity, in which retailers, manufacturers and teachers were all identified as both the source of the problem and the solution. The Home Office announced that it was talking to retailers to prevent sales to children,[[85]](#footnote-85) while parliamentarians questioned whether manufacturers could alter the formulation or delivery of the chemical to prevent it from being used as an explosive, but not affect its ability to kill weeds.[[86]](#footnote-86)

As we saw earlier in this chapter, formulations which included fire depressants already existed, and that liquid preparations did come on to the amateur market, though this was not marketed as fire prevention but simply as convenient for the gardener. The continued visibility of sodium chlorate's potential for misuse appears to have stimulated some manufacturers to change their formulation, such as ICI, who by 1970 advertised that their sodium chlorate weedkiller contained fire depressant.[[87]](#footnote-87) This showed that the company were keen to avoid their amateur gardening products being connected with accidental fires, not to mention deliberate explosions.

The focus of concern tended to be the protection of children who might use the chemical to make bangers, rather than more serious, politically motivated, adult explosive-makers, although the politicians did keep the legitimate user of sodium chlorate in mind with their desire to not alter the herbicidal properties of the chemical.[[88]](#footnote-88) The implications for gardeners of any changes to the soil of adding fire suppressant chemicals such as sodium chloride, sodium carbonate or borax,[[89]](#footnote-89) were not discussed in gardening publications. Sodium chlorate was used for total, rather than selective weed-killing and was expected to be long term so any changes to the soil wrought by the new additives went unnoticed or were negligible by the time the area was replanted. This indifference by one set of users to the measures implemented by manufacturers to accommodate the alternative use by another far smaller set of users should be remarked upon.

Despite pleas from schoolboys who's adventures with homemade explosives had either disabled themselves physically or economically through the acquisition of a criminal record[[90]](#footnote-90) progress on the subject of preventing sales to minors was slow. In May of 1970, Boots sent a special announcement to all of its shops, which requested that tins of sodium chlorate be displayed out of the reach of children, and instructed staff to affix labels that declared the product should "not be sold to children under 18" to each tin in stock.[[91]](#footnote-91) These actions show that Boots was serious about attempting to stop the sale of that chemical to young people, who were deemed particularly likely to use it for pyrotechnic purposes. The long delay between the discussions and one of the major retailers of sodium chlorate taking steps to restrict the chemical may indicate quite a number of possibilities, including resentment at the assumption that sales staff would not question or refuse a youth, opposition to tighter controls in general, or the difficulty in implementing them. Despite Boots' efforts to prevent sales to minors, their continued production of sodium chlorate weedkiller without a fire depressant[[92]](#footnote-92) somewhat contradicted their efforts.

Illustration 11: Announcement sent to all Boots branches

Although the sale of sodium chlorate to children might have been a problem, obtaining an amount from a relative's herbicidal stock was even further beyond governmental influence than sales. This potentially more frequently used supply route does not appear to have been discussed, nor were there any specific suggestions that adult gardeners should monitor or guard against their supplies being pilfered for this use. Certainly it was not suggested in the newspaper or magazine gardening columns that securing personal supplies against this use might be considered.

More serious than school boys' bangers were the larger bombs made by political and activist groups. The tightened controls on commercial explosives from 1970 saw increased employment of chemicals used in agriculture and the garden to construct bombs and oxidising nature of sodium chlorate was put to work in variety of ways. In 1970s Northern Ireland the IRA, Provisional IRA, Ulster Volunteer Force and Ulster Defence Association used sodium chlorate mixed with nitrobenzene became a filler in pipe bombs, but it was also used as propellant, (along with another household item, the J-cloth) for ammonium nitrate mortar bombs,[[93]](#footnote-93) and as a component in delayed chemical ignition systems.[[94]](#footnote-94)

Although these explosives were called homemade, this moniker was used to convey that the materials were not purchased as ready made military provisions. Lock up garages and other non-domestic buildings, not domestic garages attached to homes, were used as bomb making sites. This removal from the home was to reduce danger to other family members as well as to minimise forensically incriminating materials from the home from becoming associated with the bomb. However, other less well-informed and professionally organised bomb makers did construct devices at home, and arrests made of members of anarchist group the Angry Brigade (unrelated to the ideologies of the Troubles) found bomb making equipment and chemicals, including sodium chlorate, at their home address which demonstrate this.[[95]](#footnote-95)

Frequent high profile bombings carried out by paramilitary organisations who used sodium chlorate in explosives in Northern Ireland led to the imposition of restrictions in that region on sales of the chemical in 1972. Although the idea of restricted sales of sodium chlorate to prevent its use in terrorism was supported in principle, Whitehall politicians also stressed their reservations about the effectiveness of this gesture. Perhaps the experience from 1939 into the 1940s of the Prohibited Chemical List; the limited effectiveness and resistance to sales monitoring were not completely forgotten, but sodium chlorate was not mentioned by name. Enoch Powell called the order "pathetic" and "unlikely to correspond with any of the hopes expressed in connection with it".[[96]](#footnote-96)One parliamentarian recalled his own experience of making homemade fireworks and sodium chlorate's reliability to in his attempt to refocus attention to the arguably more serious threat of systematic theft of commercial explosives and detonators from industrial sites.[[97]](#footnote-97) Through the desire not to disrupt benign domestic use, nor cause trouble to manufacturers and retailers, but to be seen to take action against the bombers, the order was ineffectual. Despite regular and publicised arrests relating to unlicensed bulk transport of sodium chlorate, the chemical continued to be used in explosives throughout the conflict.

Neither this deliberate use of the chemical for destructive purposes, nor the huge, accidental explosions which occurred at residentially located storage depots, causing homes to be evacuated in Renfrew (1977), Barking (1980)[[98]](#footnote-98) and damaging homes in Salford (1982),[[99]](#footnote-99) appeared to shake gardeners from their loyalty to sodium chlorate. From the lack of discussion or need for reassurance in the gardening media, domestic gardeners seemed to be able to, entirely reasonably, compartmentalise the risk of explosions with the way that large amounts were warehoused, and not attribute the same possibilities to the comparatively minuscule amounts stored at home. In this case, the problem was not believed to be with the chemical, its uses or users, but with planning procedures which allowed close proximity of chemical warehousing to residential property and warehouse management.

It should be noted that the calls for the addition of fire suppressants to sodium chlorate which had been prevalent during the 1960s when children were involved in small, accidental explosions dried up when sodium chlorate was used in intensive political terrorism in the 1970s. It might have been expected that manufacturers would have been publicly called upon to help prevent this use. However, the readily available British Agrochemicals Directory published from 1970, listed manufacturers of sodium chlorate herbicide and described whether it included fire suppressant. The directories showed that numerous suppliers continued to offer pure sodium chlorate. It could be argued that fire suppressants could have had a larger role in preventing the chemical from being misused in this way and that the government working with the agrochemicals associations could have taken more serious approach to security had they insisted that all suppliers added this safety measure. No manufacturers or particular brands of sodium chlorate used in these attacks were publicly identified, and the analytical capabilities of this period were not yet advanced enough to distinguish the manufacturers of apparently identical products, so only the chemical, not the producer, was implicated in attacks. This meant that chemical companies were not held to account for producing chemicals that could be used in this way, and the paramilitary users of the herbicide able to continue.

### Poisonings

Although sodium chlorate's reputation was as a harmless and nonpoisonous substance, this did not stop people from using it as a poison. In the case of sodium chlorate, the poisoners were both men and women. Sodium chlorate was reported by a pathologist as tasting noticeably bitter, making it unsuitable for surreptitious poisoning, but this did not stop people from trying, allegedly adding it to sandwiches,[[100]](#footnote-100) tea,[[101]](#footnote-101) and cereal.[[102]](#footnote-102) These British cases were unsuccessful poisoning attempts, carried in newspapers for their human stories of love affairs, angry husbands and suspicious wives, while disseminating the message that sodium chlorate was not an effective poison for humans.

Despite this insistence that sodium chlorate was harmless, recovery from chlorate poisoning involving doses of 20g or more was rare, and sodium chlorate was used for deliberate, fatal self-poisoning.[[103]](#footnote-103) However, it was even rarer to find mention of this use outside medical journals, except as part of a failed and farcical attempt.[[104]](#footnote-104) The low news exposure, despite being readily available to gardeners, explains why this use did not become popularised. Similar to the use of sodium chlorate in explosives, no brands of this chemical were ever publicly identified in poisoning cases, but that is not to say that the chemicals used were unbranded. With respect to its use as a poison, all brands could have poisoned so there was no special action that could have been taken to avoid this misuse, in contrast to the addition of fire suppressants which prevented accidental fires and the misuse of the chemical as an ingredient in explosives.

Therefore it came as something of a surprise when the EU determined that sodium chlorate should be withdrawn from the market because of unspecified but expected harmful effects on human health and no definitive acceptable operator exposure level, not, at least on the face of it, its potential to be used as an oxidising agent in improvised explosives.[[105]](#footnote-105) Other than occasional autumnal calls for controls on sales to children, sodium chlorate remained on sale as a weedkiller until 2009, and it record on human toxicity was not called into question. The ban meant that in Britain 41 amateur products (including fire depressed brands) and 14 for professionals were withdrawn from the market. However, this supposed ban on sodium chlorate weedkiller sales is ineffective, as the chemical can be easily found online. Instead of being offered as a herbicide, it instead carries a warning that the chemical, ostensibly for leather tanning use, will kill all plant life if applied. These tactics are negated by the fact that even if the seller had not categorised it as a weedkiller for driving sales, the aggregation of website user information such as which other products they considered or bought, mean that sodium chlorate is identified as being sought out by gardeners hoping to solve problem weeds. Other users in their product reviews, rather than the manufacturer, supply information about how to use it on weeds.[[106]](#footnote-106) The birth and growth of online sales, as well as communication and behavioural monitoring among users and misusers, as all the users in this example do not use the product for leather working or bleaching, will provide rich topics for further historical investigators.

# Paraquat

This final case study is the most complex of the three herbicides covered in this chapter, both in its chemical structure and in it's relationship to users. "Paraquat is the B.S.I. (British Standards Institution) common name of the cation 1,1'-dimethyl-4,4'-bipyridylium, which is available as the dichloride of the di(methyl sulphate)."[[107]](#footnote-107) This formal, chemical description of paraquat instantly shows us that we are dealing with quite a different substance to sodium chlorate or sulphate of ammonia. Those compound names are clearly linked to the elements which comprise the product a domestic gardener might have bought, whereas paraquat's relationship to its chemical composition is far less obvious to the average user. Imperial Chemical Industries (ICI) discovered the chemical's herbicidal strength in 1947, and work started in earnest to characterise, test and formulate weedkillers based on paraquat from 1955. This endeavour took place at a subsidiary company of ICI, Plant Protection Limited (PPL) at their test farm Jealott's Hill (see table 2).

Paraquat was available to agricultural and horticultural professionals in 1962 as a product called Gramoxone, then amateur gardeners could buy Weedol from 1965. Sodium chlorate and lawn sand did not have this division between professional and amateur, but it had become common practice with new weedkillers. To get to this stage paraquat had passed the scrutiny of the new Pesticides Safety Precautionary Scheme in terms of its danger to the health of users and others, then the Agricultural Chemicals Assurance Scheme judged its efficacy. Paraquat quickly acquired a reputation as a "killer chemical" and not just for its action on plants. Since it came onto the market, acute paraquat poisoning has been responsible for more deaths in Britain than all other pesticides combined. Between 1945 and 1989, 1012 deaths from pesticide poisoning occurred, with paraquat responsible for 570 (56%). To provide perspective, the 1012 deaths made up only 1.1% of all fatal poisonings, so were proportionally not the largest domestic poison threat.[[108]](#footnote-108) Nevertheless, paraquat's reputation makes it an interesting case study. This section of the chapter looks at the development of paraquat as a herbicide, its uses in Britain, and how some users ignored the categories set by the product makers.

Paraquat was promoted as a chemical plough to farmers.[[109]](#footnote-109) For domestic consumers, who were of secondary importance to large scale agricultural users, this was scaled down to the equivalent garden tool, the hoe. Although ICI aimed to eliminate these behaviours, neither gardeners or farmers gave up these tools.

| **Date** | **Regulation/context** | **ICI Activity** | **Paraquat Event** |
| --- | --- | --- | --- |
| 1883 |  |  | Paraquat first synthesised, used as redox indicator (not ICI) |
| 1927 |  | ICI bought Jealott's Hill farm, set up propaganda unit |  |
| 1933 | Pharmacy and Poisons Act, est of Poisons Board |  |  |
| 1937 |  | Formed Plant Protection Limited with Cooper McDougal and Robinson |  |
| 1947 | Fuel crisis holds up manufacture of raw materials needed by chem ind. |  | Herbicidal activity discovered at ICI |
| 1952 | Agriculture (poisonous substances) Act |  |  |
| 1954 |  |  | Boon and others moved from Dyestuffs at Blackley to Jealott's Hill |
| 1957 | Pesticides Safety Precautionary Scheme; Consumers Association (Assocn for Consumer Research Ltd) | Alderley Park opens and Pharmaceutical Division moves there, independent |  |
| 1959 |  | PPL losing money, became wholly owned by ICI, restructure of PPL | First large batch paraquat made |
| 1961 |  | Paraquat pioneer production plant |  |
| 1962 | Silent Spring published | Second production plant for paraquat, Gramoxone enters agricultural market |  |
| 1965 | Chemicals for the Gardener v2 | Weedol enters domestic market |  |
| 1966 |  |  | First paraquat related deaths recorded |
| 1967 | Farm and Garden Chemicals Act passed (not in force until 1973) | PPL gains Queens Award for export activities, mainly due to paraquat |  |
| 1968 |  | Improved paraquat production plant | 1st paraquat deaths reported in mainstream media, added to Poisons List |
| 1972 | Poisons Act, Poisons Board cont. |  |  |
| 1973 | oil crisis; Economic recession until 1975 |  | Patent expires, but ICI remain only producer in UK |
| 1974 | Health and Safety at Work Act; Health and Safety Commission established | Stenching agent added to Gramoxone | Stricter rules for poisons sales. |
| 1975 |  | Weedol changed to include diquat, reducing the paraquat content. |  |
| 1977 |  | Emetic added to all formulations |  |
| 1981 | Wildlife and Countryside Act |  |  |
| 1986 | HSE enforces pesticide safety |  |  |
| 1987 |  |  | Germany refuses to use paraquat |

Table 2: Timeline of relevant company activities and key events in paraquat's development

Gramoxone arrived with farmers as a brown liquid containing paraquat at a concentration of 20%, which users diluted in their new, specially designed, dedicated application equipment. To domesticate paraquat, PPL planned to offer a less concentrated liquid herbicide in a smaller volume to home gardeners, branded as Weedol.[[110]](#footnote-110) Although Weedol was a weaker concentrate, when it was diluted for use it was equally effective. The intention behind giving domestic users a less concentrated product was to avoid the risks associated with in storing a high strength chemical at home. However, these differences and rationale were not explained to either agricultural or domestic users. Unlike sodium chlorate and lawn sand, paraquat was caustic to the users' skin and while the regulatory board considered agricultural users competent to handle liquid paraquat, they were apprehensive about allowing domestic users a similar product and worried about allergies among domestic users. The committee refused to give liquid Weedol clearance and demanded better understanding of its physiological effects on humans, particularly it's irritant effects on skin. PPL withdrew its application while it tried to satisfy the PSPS, but ultimately they did not get to the bottom of the irritant mechanism. Having picked up that the committee had been particularly worried by the toxicological data that diquat had been shown to cause cataracts in rabbits, decided to change the formulation from a mixture of paraquat and diquat to just paraquat which did not have this effect. Results of lethal dose tests on rats and rabbits showed paraquat had no effect when eaten in small doses, but it did kill when it was eaten in large amounts. As far as anybody could tell, paraquat was a skin irritant which disrupted nail formation and could be poisonous in large doses. Tissue examinations did not show any particularly unique toxicity, though the collection of fluid in the lungs was noted and not thought to be the cause of death.[[111]](#footnote-111) The approved amateur product that emerged from these several rounds of negotiations was pre-weighed sachets of solid pellets containing 5% paraquat, that the domestic user dissolved directly in a 2 gallon watering can or sprayer.[[112]](#footnote-112) In this way, amateur gardeners did not have to measure it out, avoided splashes and blistering, and they would only make enough to be used for that session of weeding which avoided storing the solution for future use. Gardeners were instructed not to alter the proportions of Weedol to make a more concentrated solution, so the freedom that experienced with sodium chlorate to use as they saw fit for their own garden was specifically ruled out and some of the expertise required for using a garden chemical was removed.

ICI had run tests on a variety of standard laboratory animals and had met the requirements put to it. Until the chemical had been used in real scenarios nobody could not know for sure what all the effects on people could be. The first users of Weedol when it given provisional commercial clearance in 1964 were ICI's own staff. These were real users in real garden situations, rather than carefully controlled laboratory conditions, and they were able to feed back information about their experiences as users directly to the company, which then shaped the usage instructions.[[113]](#footnote-113) The labelling and instructions for Gramoxone and Weedol remained malleable during period of provisional PSPS approval, so that user behaviours which came to light in the information collected by ICI and committee members about all the accidents and incidents relating to paraquat products, could inform any necessary amendments. These were often initially from coroners reports which appeared in newspapers,[[114]](#footnote-114) rather than directly through a system of hospital reporting. Although all this regulatory activity was behind the scenes, it was communicated in part to users through the "Approved by the Agricultural Chemicals Approval Scheme" logo which was either visible on any packaging or integrated into the advert body.[[115]](#footnote-115)

In 1964, the same year after Weedol was approved, and after two years of incident-free use of Gramoxone, accidents began to happen among agricultural workers which confirmed that paraquat was indeed poisonous to man. These accidents with Gramoxone related to two specific instructions associated with the product: that it must never be repacked and that it was "not to be taken". In carefully wording these instructions, the consequences of noncompliance were not explained, so their significance was not emphasised. As the number of accidental poisonings that occurred due to mistaken identity after Gramoxone had been decanted into bottles slowly increased, Roy Goulding founder of the National Poisons Information Bureau[[116]](#footnote-116) and a member of MAFF's Poisons Board which fed into the PSPS, wondered how to prevent further accidents: "How we can deter them I don't know, but labelling the concentrate as poison might help.'"[[117]](#footnote-117) Pressure also came from representatives of agricultural users, when the Essex branch of the National Farmers Union (NFU) wanted the severity of dangers of misusing Gramoxone to be emphasised on the label.[[118]](#footnote-118) ICI had been resistant to suggestions that the word 'Poison' should be included on the label, as they did not want potential users to be scared by the product being categorised along with strychnine and arsenic and avoid their product, nor did they want people to use it as a poison. They called attention to other agricultural chemicals that only needed to have the word "caution" on their labels despite their acute toxicity in rats being greater than that of paraquat. They maintained that when users followed the instructions, the product was safe.[[119]](#footnote-119) While the PSPS advisory committee accepted that no deaths had followed appropriate use, they were concerned about users who may not follow the instructions.

In contrast to sodium chlorate and sulphate of ammonia, which were sold freely to anyone with only quantity being of concern, it was the concentration of paraquat in professional and amateur forms that meant Gramoxone sellers had to be registered and were expected not to sell it to domestic users. This was initially an agreement, rather than a legislative restriction. The minimum packaged volume of Gramoxone, 1 gallon,[[120]](#footnote-120) was much larger than a domestic user would ever need for their own garden, and the cost of this quantity was considered high enough that small-scale domestic users ought to have been deterred. However, neither this agreement or the subsequent addition of the product to the Poisons List, or the following reclassification provided a watertight demarcation between domestic and professional users. Not all retailers were strict, and there was demand from small scale agricultural users, crofters and people with small-holdings to provide smaller portions. These types of users, especially in Ireland according to ICI, were likely to buy small amounts of agricultural chemicals in reused containers such as drinks bottles and store them in their homes and so were disproportionately accidentally poisoned.[[121]](#footnote-121) In 1967 ICI sent what they called a "strongly worded letter" to its main agents and distributors reminding them about the dangers of selling Gramoxone that was not in its original container.[[122]](#footnote-122) This problem was not confined to Ireland, a chemist in Cambridge was found guilty of gross carelessness and fined after they sold Gramoxone in a reused lemonade bottle to a schoolmaster and delivered it to his doorstep.[[123]](#footnote-123)

Allotment associations had been identified as a potential route of permeability in the separation between bulk and domestic use,[[124]](#footnote-124) and inevitably they were the source of some illicit paraquat that ended up in homes.[[125]](#footnote-125) In 1968, fears of horticultural associations as the root of an accidental poisoning were realised. Mr Smith, a haulage contractor, obtained the weedkiller through an allotment association and stored it in a soft drink bottle in his shed. His 15 year old son Alex drank it, believing it to be cola. This was the first paraquat death to be reported in national news, but neither the weedkiller, the involvement of horticultural club or how Alex came to encounter the poison were the focus because Alex became Europe's first lung transplant patient..[[126]](#footnote-126) Alex's character was commented on positively, fitting his status as brave patient involved in a risky and pioneering operation. He was pictured cheerily sitting in his hospital bed[[127]](#footnote-127) and described as having "no previous significant history ... a well-balanced, intelligent, and stoic individual"[[128]](#footnote-128) This was a departure from the list of poisonings compiled between 1966 and 1967 by ICI representatives. The incidents emphasised the fecklessness of the misuser, and their explicitly prohibited behaviour.[[129]](#footnote-129)

Small scale users such as allotment holders and amateur gardeners, should not have had to ask retailers to break their agreement, or to deceive them or find loopholes, as from 1965 Weedol was widely available, rather than limited to registered sellers like Gramoxone. Weedol adverts suggested simply going to "your shop",[[130]](#footnote-130) instead of listing the diverse outlets that users might prefer to buy their garden supplies. Weedol was packaged for shelf display and self service, with plenty of information incorporated on the exterior of the packet. Even some of the language in the instructions had been simplified, with "weedkiller" in place of herbicide and "breathe" instead of inhale.[[131]](#footnote-131)

In response to accidents with Gramoxone, liquid formulations were included in the lowest grade, Schedule II, of the Poisons List,[[132]](#footnote-132) effective from August 1968. This demonstrates how a very small number of users outweighed the majority of compliant, careful users and caused Gramoxone to be classified as a poison. When agricultural paraquat was added to the Poisons Schedule, care was taken to explain that the granular Weedol was exempt from these restrictions on sale, even if the differences between professional and amateur products were not better clarified.[[133]](#footnote-133) Publicly, ICI welcomed the stricter rules also blamed the new regulations on those "silly and irresponsible"[[134]](#footnote-134) retailers who had broken the conditions of Gramoxone's sale.[[135]](#footnote-135) Scheduling was quickly exposed as ineffective in 1972 when investigative reporters from the Daily Mail bought Gramoxone from different vendors around the country. The journalists found that the salespeople charged with regulating access to these dangerous chemicals exhibited very little interest in buyers or what their plans for the chemical were.[[136]](#footnote-136) The volume of negative publicity associated with paraquat poisonings worried the NFU, who were anxious that clamping down on retailers could make Gramoxone more difficult for farmers to obtain for legitimate use.[[137]](#footnote-137)

There was little vocalisation from the families of people who had been poisoned by paraqat, except when organised by the *Daily Mail*. An exception was George Staples, who wrote to his MP following the inquest into his son Robert's suicide. Robert had taken his father's small amount of illicitly decanted agricultural strength paraquat and Staples declared that he was "astonished... and disappointed" that there was no recommendation to withdraw the weedkiller.[[138]](#footnote-138) This letter is the only one from a relative of a paraquat victim that appears in the Home Office archives, which makes him unusual, but even more so that he considered the chemical should be taken off the market. The only other traces of reaction from bereaved relatives are found in newspaper reports of the inquests of poisoning, which carried only truncated statements of regret about their disobedient actions, as in the case of Mr Parsons who's daughter Deborah was accidentally poisoned by Gramoxone he brought home in a Pepsi bottle who said "It was my own stupidity".[[139]](#footnote-139)

Paraquat being taken off the market was considered "a shame" because it was such an effective agricultural weedkiller, not to mention the job losses that could follow if the plant was shut down, so of course ICI were "happy to see a much stricter rating" to reassure people "appalled" at the laxity of control. In 1974, it was well publicised that Gramoxone had been reclassified as a Schedule I poison.[[140]](#footnote-140) The difference as a Schedule I poison was that the buyer had to sign a poisons book. As well as recording who was buying the product, signing the book was intended to emphasise to the user that they should take special care with the product.[[141]](#footnote-141) In addition, buyers should have a certificate stating that they were entitled to buy poisons. These safeguards sounded good but were superficial and easily circumvented by anyone determined to get hold of the product. Buyers entered false names into the Poisons Book[[142]](#footnote-142) and "all householders are authorised to give certificates certifying a person to be one to whom a poison may properly be sold" according to Rule 36 of the Poisons Rules 1972.[[143]](#footnote-143) [[144]](#footnote-144) Needless to say, these measures did not resolve the problem of deliberate and accidental paraquat poisonings and managing the relationship between buyers (legitiate or not) and retailers was very difficult.

ICI's approach to publicity and packaging facilitated domestic users making a hazy distinction between the agricultural and domestic paraquat products. Combined with reluctance in mainstream media to refer to product brand names, a lust for paraquat had been stirred up rather than making an effort to direct each group of user to their respective product. When domestic and professional users simply referred to using "paraquat" in the garden, they mirrored the lack of information about concentration that was apparent in the most publicly visible arenas. While the chemical name "paraquat" was always clearly visible in the adverts and on the packaging as the reason for choosing that product, there was otherwise a complete lack of distinction between the concentrations meant for different user groups, emphasised only in the warnings or admonishments which followed accidents.

On the whole, domestic users would have been highly unlikely to have encountered sales adverts for Gramoxone, although they may have seen it mentioned in profile-raising adverts from ICI. As well as being carried by different publications, adverts for Gramoxone and Weedol differed in both style and content, which emphasised the separation between the products and their intended users.

The adverts for Weedol are summarised in Table 3 in order to highlight the key words that were used in the adverts and to see changes over time. What cannot be gauged easily from this and is worth mentioning is that Weedol adverts occupied much more space on the page than adverts for sodium chlorate or most lawn sands ever did, reflecting the size and greater resources of the company behind the product. General trends were that early Weedol adverts were more informative than later ones, as they were crafted to explain to potential users how Weedol worked and to shape user expectations. As the product became better established and as advertising fashions changed, less explanatory text was included; new users primed by the eye-catching advert could scrutinise the packaging they recognised from the advert in store for more information about how and where to use it. Great pains were taken to put across the ease and simplicity of use, emphasising the use of the plants' own "natural" processes to kill the plant.

The language of Weedol adverts was restrained when it came to violence against weeds and instead focused on saving time and effort. They consistently highlighted the 'low' costs involved which demonstrates an awareness that Weedol was perceived by users to be expensive or that the cost had to be justified also shows in the adverts, although this was not unusual in weedkiller adverts seen earlier in this chapter. The table also shows how different socioeconomic groups of potential purchasers were reached through different papers. The *Times* rarely carried Weedol adverts, while they were carried much more frequently, in greater variety and with richer detailed in the *Express*, *Mail*, and *Mirror* daily and weekend papers. Advertising in papers that had greater circulation was better value for ICI. However, paying for advertising space was not the only way of reaching potential users, as the *Times* gardening correspondents named paraquat approximately once a month, though only rarely by the brandname Weedol.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **Advert** | **Paper** | **User image** | **Key phrases** | **Advertised Price** |
| 1965 | Ends the work of weeding | Express, Mirror | No user | Hard work, neutralised, harmless | 5/6 |
| 1966 | End the work of weeding | Express, Mirror, Mail | Hands, feet | Safely, harmless, easier, endless, economical, accurate | 5/6 (2 drum pack) 19/6 (8 drum) |
| 1967 | Don't waste time with weeds | Times, Express, Mirror, Mail | No user | Time, revolutionary, safely, save hours | 5/6 (2), 9/6 (4), 17/6 (8), 32/6 (16) |
| 1967 | My Dad's a Weedol weeder | Express, Mirror | Father (plus daughter) | Saves hours, kills, harmless | 5/6 (2), 9/6 (4), 17/6 (8), 32/6 (16) |
| 1968 | Stand up to weeds | Mirror, Mail | Male | Gardeners, revolutionary, kills harmless | 5/6 = 40 sq yds |
| 1969 | Block the living daylight out of weeds | Express, Mirror, Mail | No user | Low priced, harmless, unique, rain, time saved | Sprinkle bar 3/- applicator 15/6 |
| 1970 | [month]...in the garden with ICI | Mail, Express, Mirror | No user, but male tech advisor | Save hours of back breaking | ---- |
| 1970 | … without killing the soil or your back | Mail, Express, Mirror | Gloved hand | Backache, harmless, economical, ordinary, cost | Avg sized garden/yr 30 bob, 2 drum 5/6, money saving bulk |
| 1970 | Your garden pin up | Amateur Gardening Annual | Non-user woman | Easy |  |
| 1971 | Two ways | Mail, Express, Mirror | Male | Back-breaking, minutes, kill, harmless, cost | 40 sq yd = 30p |
| 1975 | … without killing the soil or your back | Mail, Express, Mirror | Male | Kill, safely, inactivated, economical, hours, back-breaking | ----- |
| 1977 | Fast and easy. | Mail, Express | Percy Thrower | Safely, backache | ---- |
| 1977 | ...plenty of help | Mail, Express | Percy Thrower | Compete, safely | ---- |
| 1978 | Stop weeds going to bed with your flowers | Mail | No user | Easy, kill, rain, effective | ---- |
| 1979 | Our weeders choice/ Weedol about it | Express, Mail, Guardian | No user | Kill, revolutionised, hours | ---- |
| 1980 | Don't let weeds be the first sign of spring | Times, Guardian | No user | Effective, speedy, inactivate | --- |
| 1981 | The British gardener's No.1 weedkiller | Mail | No user | Kill, harm, inactivated, risk, rain, gardeners | --- |
| 1984 | Weeds stop here | Mail | No user | Inexpensive, Care | --- |

Table 1: Table showing the Weedol advertising campaign key words. Decimalisation facilitated a price rise, with 30 pence being equivalent to 6 shillings, when previously the same pack to treat 40 square yards was slightly less expensive at 5/6.

It is hard to make solid statements of the adverts' intent as details do not appear to have been archived, but the results of some market research for Weedol show that the intended market was younger, middle aged gardeners rather than older ones.[[145]](#footnote-145) Although the market research did not explain why this segment was targeted, disposable income, being accustomed to saving time through other convenience products, as well as being open to new ideas, or at least not as habituated to the work involved in maintaining a garden are all possibilities. Nevertheless, older people did welcome paraquat, shown by the testimony of head gardener Albert Marshall in charge of Stourhead's 40 acres of rare shrubs and trees, who appreciated no longer having to remove the grass round bushes by hand,. However, they did not necessarily chose Weedol, as Grace and Josiah Walker, both in their 70s were accidentally poisoned by the industrial strength herbicide that they illicitly kept in an old sherry bottle. [[146]](#footnote-146)

Illustration 12: Stand up to weeds. All the other adverts have shown standing users, but this one makes a point of it. The user has a relaxed posture as he applies Weedol, although the work of weeding has not completely been eliminated, it no longer involves grubbing about.

The "Stand up to weeds!" advert was first placed in mid-April 1968, showing the lower half of a male user in neat trousers and a shirt, standing with a hand on his hip and holding a watering can with which to apply weedkiller.[[147]](#footnote-147) The phrase refers to both the physical action of weeding, which with Weedol no longer involves bending or kneeling, as well as overcoming the relentless invasion of weeds in ones' garden. This physicality was played on again in 1970, when a Weedol user was was compared to a ridiculously exaggerated non-user (illustration 12). This is by no means a novel strategy, as Eureka and Sofnol weedkillers employed it in the 1930s, though the other chemicals studied in this chapter did not employ this trope.[[148]](#footnote-148) The user was a middle aged man, most likely in his own garden, where he used it among flowers and shrubs, not to clear expanses of weeds or in paving seen in the sodium chlorate adverts. Through his casual clothes, his relaxed, upright stance and smoking a pipe, he gave the impression of being at leisure. The appearance of the gardener using Weedol in these adverts communicate how easy and clean using the product was. If Weedol was not available, meaning they had to manually weed instead, they would have to wear clothes that they did not mind getting stained with grass or mud. The presence of the pipe indicates masculinity, that he is unhurried and at leisure,[[149]](#footnote-149) but also that Weedol is safe to use. If the user had to weigh out the chemical, they risked getting it on their hands then transferring it to the pipe and from there into their mouths.

Although claims were made on Weedol's packaging for paraquat's position in the revolution of weeding, no adverts depict anything particularly chemical, revolutionary or modern, in keeping with sodium chlorate and lawn sand which might show people using the chemical or a simple garden scene. No fantastical situations were dreamt up, applying weedkiller was presented a mundane chore while the power and dominance of the user over weeds was kept low-key. These very ordinary domestic images work to normalise chemical use and emphasise that it was nothing unusual, that while the pace of life may have speeded up, once safely at home gardening was still very much a leisurely activity.

Illustration 13: Two Ways to Weed. The dishevelled figure is contrasted with a man at leisure, the hand in pocket stance is repeated from Stand Up to Weeds.

### Disobedient or Careless Users

These advertising images were in contrast to the "science fiction" of paraquat poisonings. What surprised doctors who treated the first Gramoxone poisonings, not to mention all those who had been involved in examining the chemical's risks and hazards, was that paraquat had a peculiar effect on lung tissue. It irritated and thickened the membranes across which gas exchange occurs, which reduced the efficiency of the organ, and also caused cell proliferation (a repair response) in the lungs, so much so that they solidified. ICI conducted further research into paraquat poisoning at their Central Toxicology Laboratory, publicly demonstrating responsibility and appearing to placate some observers but without withdrawing any chemicals, and found that paraquat reacted with a cellular transport process in the lungs, causing this characteristic damage.[[150]](#footnote-150)

Despite doctors’ best efforts to deactivate paraquat with Fullers earth, or kaolin, which mimicked the chemical's deactivation seen in soils[[151]](#footnote-151) their treatments were experimental and often unsuccessful. Mainstream media coverage invariably conveyed the lack of effective treatment available, often with the stock phrase "no known antidote". As father of paraquat Bill Boon wearily noted, this statement was technically accurate, but not unusual as in the true sense of antidote where one chemical neutralises another, very few poisons have an antidote, not even aspirin.[[152]](#footnote-152) However, the phrase became inseparable from paraquat and was not used for reporting poisonings with other substances. It grabbed attention and was useful shorthand for expressing the despair that was experienced by victims, their families, and the medics who cared for them. Although not articulated in documentary sources, the incongruousness between the knowledge that a chemical that had this severe effect and the idea that it had been approved for safe use, combined with the isolation rather than explicit public comparison with other regulated chemicals or drugs that could also have negative effects, amplified the message that paraquat was somehow special. Only in the way that it had been passed through the regulatory hoops was it special, though the ability of a chemical promoted as harmless and safe to be fatal to users was in no way unique, because harmless, non-poisonous and safe sodium chlorate could also kill. The difference between deaths related to sodium chlorate and paraquat was media attention.

Workplace theft was another route of professional paraquat entering homes.[[153]](#footnote-153) None of the other reported cases of accidental poisoning were linked so closely to the chemical company, as that of 6 year old Beverley Pollitt who died in 1968 after she drank Gramoxone from a lemonade bottle at home. Her father had asked an ICI employee if they could get some weedkiller for him, who although he did not personally work with Gramoxone, duly took some that had been stored in the Rigger's cabin for use on the site.[[154]](#footnote-154) While in this case the production line was not under scrutiny, the liberation of paraquat formulations from the ICI plant was not uncommon: it "leaked out of the plant like water off a roof" according to someone who did not have any connections with the plant, other than living in the area.[[155]](#footnote-155) Mr Pollitt did not request paraquat, he asked for weedkiller and the man who stole it claimed to not even know exactly what the weedkiller he pilfered was. It was, and still is, puzzling why domestic gardeners did not want to use Weedol which had been specially formulated for them.

In trying to understand what motivated people to bring home Gramoxone, MAFF described these domestic users as trying to avoid the expense of buying Weedol.[[156]](#footnote-156) Certainly, Weedol was perceived by users as expensive. Market research revealed that from its introduction, potential users expected the price for such a product to be between 3/7 – 4/- rather than the recommended retail price of 5/6.[[157]](#footnote-157) In table 3, we saw that the advertised price of Weedol remained remarkably stable over time, which reflected the need to recoup the costs of development and manufacturing, extended by the changes in formulation to satisfy safety concerns, but the high price may have frustrated and even deterred some would-be users.[[158]](#footnote-158) Early on in Weedol's provisional commercial clearance the PSPS expert groups had identified the high cost of Weedol had been identified as a potential push factor for some users towards the cheaper Gramoxone, and the likelihood that it would be stored inappropriately.[[159]](#footnote-159) No change in the price of Weedol spurred an investigative journalist to calculate that the domestic product was eight times more expensive than Gramoxone, who suggested that reducing the cost of Weedol would make it more attractive.[[160]](#footnote-160) Perceiving the industrial concentrates as stronger and therefore better was not a sentiment expressed, at least in newspapers and magazines, so price or simply getting something for free, may well have been the driving force behind it.

This section has focused exclusively on accidents involving Gramoxone, which was never intended to be used domestically. From Weedol's launch in 1965 to May 1967, 7 million units were sold, in which there were five non-fatal medical incidents reported associated with normal use. Only one was a poisoning, where a child 'who should not have access to the preparation' ate the granules, and the others were skin irritation due to 'carelessness'. Considering the volume sold, this is a tribute to how safe the domestic product could be.[[161]](#footnote-161) Even in these cases, gardeners who had experienced negative health effects were reported to have carried on using the product.[[162]](#footnote-162) This indicates that Weedol was useful to home gardeners, and was generally used safely. Although avoiding corrosive splashes was behind the advice to make soluble granules, this preparation had the benefit that it could not be mistaken for any other household or edible ingredients.

## For use only as a herbicide

What is notable was the relationship between reporting accidental poisonings and the perpetuation of suicidal and criminal poisonings. Table (Appendix) shows this

Even when newspapers appeared to either lose interest or reassess their ethical position on reporting paraquat deaths in the late 1970s, high numbers of paraquat suicides as well as a smaller of 'other' deaths continued to take place (see table Appendix). In reporting how easy it was to obtain Gramoxone and what size dose was fatal, media reports effectively put the idea into public circulation, validated and perpetuated misuses of paraquat. When compared to sodium chlorate which very rarely received such publicity, the role of the media in popularising paraquat to cause harm is stark.

Coincidentally, this was also about the same time that successful treatments of paraquat poisoning were being reported (see table, Appendix).

Paraquat had moved from the confines of niche columns about agriculture and gardening to the main body of newspapers through articles about the harm that paraquat, specifically Gramoxone, could cause when misused. The graph in Figure 2 shows the frequency of reports in the Daily Mail on paraquat involved in accidents, murders and suicides. Visualising the frequency in this way suggests the level of public exposure to the concept of paraquat causing human death, but it does not show separate incidents, as accidents might be reported as the outcome of a coroners report, or several articles might be associated with the same story. Suicides were comparatively rarely reported, so we cannot blame the media for glamorising this use. What the graph demonstrates is that as knowledge of paraquat ingestion being fatal became more widespread through the reporting of accidental poisoning, stories of intentional paraquat fatalities followed.

*Figure 2: Graph showing the focus on accidents, murder and suicide using paraquat weedkillers.*

Although newspapers played a part in generating hysteria around paraquat as a poison, they were also seen as an important medium to educate people about safe storage and use of chemicals in general, as well as regulatory efforts directed to paraquat. Their articles were considered so effective that civil servant R.A. Kendall wondered "whether there is much scope for useful Government publicity on top of all the educative publicity already given by the newspapers to paraquat accidents".[[163]](#footnote-163)

## Preventing Misuse

Paraquat was not suitable for any other household uses, it did not double as an insecticide, its chemical qualities did not facilitate its incorporation into improvised explosives like sodium chlorate, it could not be employed to kill slugs or to concoct any other garden aid as sulphate of ammonia could. However, users demonstrated that they were very hard to control through words alone. People could easily or willfully ignore printed and verbally given instructions and vendors could simply not carry out their responsibilities, the threat of fines and being prevented from selling Gramoxone were apparently not enforced strongly enough to be effective deterrents. Although ICI representatives put full responsibility for accidents on users' noncompliance with their instructions, in order to continue being able to sell their herbicide they had to make their product harder to accidentally misuse.

Changes to formulation

When accidents with Gramoxone occurred in domestic situations, accidental consumption was the problem to be solved. Despite reservations that “those who drank paraquat in mistake for something else tended in any case to swig their drink back, without stopping to savour the bouquet"[[164]](#footnote-164) the addition of a stenching agent was one of the first changes to Gramoxone's formulation. The off-putting smell was expected to alert the user to the noxious nature of liquid and prevent poisoning through mistaken identity or secretive administration by a poisoner. If the stenching agent had not deterred the drinker, another line of protection was later added in the form of another ICI discovery, a triazolopyridine referred to as PP-797 made by FL Rose and colleagues. From 1977 PP-796 was added to both Weedol and Gramoxone to make people vomit and reduce the amount of paraquat that could be absorbed.[[165]](#footnote-165)

In an effort to prevent small amounts of the concentrate being stored into an inappropriately labeled bottles, it was suggested that ICI should offer small bottles of Gramoxone in order to reduce accidental poisoning.[[166]](#footnote-166) However, ICI did not implement this in Britain because of their experiences of selling small bottles in Japan where most farmers operated on a scale that needed smaller volumes, as it turned out to be almost an invitation to suicide.[[167]](#footnote-167) Despite the reported problems of home Gramoxone use all relating to ingestion, there was no serious discussion of granulating the industrial strength herbicide. ICI's revolutionary new system of agriculture relied on equipment to apply liquid, so farmers worldwide were locked into this mode of delivery. It would not have been easy to switch agricultural users to solid concentrate and for a farmer a blocked sprayer was far more infuriating and expensive than an amateur gardener's blocked a sprinkler bar on a watering can. Therefore, ICI researched making the liquid formulation thicker so it would be harder to swallow, or into a jelly-like formula, compromises that could accommodate their professional and amateur paraquat users.[[168]](#footnote-168) There was no comment on the prospect of a Gramoxone jelly shifting the problem from bottles to those other readily available reusable domestic containers, jars.

The issue of Gramoxone being mistaken for dark coloured drinks presented a target for change. In a parliamentary debate on the Farm and Garden Chemicals Act, it was proposed that manufacturers of any garden chemical should strongly consider the appearance of their products, using the example of Gramoxone's visual similarity to cola.[[169]](#footnote-169) This echoed older strategies of colouring poisonous chemicals, for instance giving normally white arsenic and strychnine formulations unmistakably vivid colours in order to avoid accidental poisoning.[[170]](#footnote-170) However, Gramoxone was a dark liquid, so it was much harder to add a colour that would stand out and ultimately was not achieved.

### After paraquat

New garden weedkillers were put onto the market with the specific claim that they did not contain paraquat. This can be interpreted as a reaction against the perceived danger of paraquat and fulfilling a desire among gardeners for an alternative product, and there is a parallel with the adverts for products in the 1930s that stated that they were as effective as arsenic but not poisonous. When DeeWeed and Leroco were advertised with the claim that they did not contain paraquat or sodium chlorate, the fact that the effect would last at least 3 years indicates that they would not be a direct competitor to paraquat.[[171]](#footnote-171) Nevertheless the assertion that it is neither of these well known chemicals demonstrates that users were percieved to want this reassurance, either to avoid the chemicals or to know that they were getting an alternative product.

The demand from gardeners for a contact herbicide that did not persist in the soil meant that Weedol was not immediately displaced from its position in the market so continued to be available. It also shows that a significant majority of users who bought and used the herbicide were not shaken by the negative publicity that paraquat as an active ingredient received, considering themselves to be competent users. ICI had been able to reassure users that they were concerned about consumer welfare by changing the formula, as well as by being active in understanding paraquat poisoning and developing treatments for poisoning victims. The amount of paraquat in Weedol was reduced by replacing half with diquat, but because of the niche the weedkiller occupied regarding how it would be used in the garden, it would only be displaced when a product that could be used in similar circumstances was available. Concerns about the long term, low dose effects of paraquat whether through exposure during application or appearance in ground water, flags indicating neurotoxicity of paraquat, its possible implications in Parkinsons disease and cancer had not emerged or do not appear to have been transmitted to amateur gardeners at this time. The focus during the 1960s, 70s and 80s was on acute poisoning, even when agricultural pesticide spraying was fingered as the cause for sudden onset of severe, long term illness, although there was generally growing awareness of the potential for unknown effects from minuscule, cumulative and combinatory doses of chemicals in the wider sense.

Despite confused reports about herbicides and claims that paraquat had "disappeared from many products" in 1988, Weedol with ingredients paraquat and diquat prominently as stipulated by law, was still on sale and regularly advertised well into the 1990s.[[172]](#footnote-172) The addition of an emetic meant fear was considerably dialled down, at least with regard to it being accidentally lapped up from domestic watering cans by family pets. Nevertheless, professional paraquat products still ended up in the domestic fridges and hands of people who had no connection to farming or landscaping, into the 2000s. The farming news announced and gently mourned paraquat's UK ban in 2007, and Weedol's formulation shifted again so now diquat made up 100% of the active ingredient. Attention had well and truly shifted from paraquat by the time these changes took place, as no word of them was included in mainstream media despite previous outrage about the effect of paraquat on frogs, residue on food crops and the disparity that it had already been banned in several other countries in the EU and worldwide.[[173]](#footnote-173)

Glyphosate's arrival on the market in the early 1980s contributed to this very quiet end for paraquat; it occupied the same niche, it broke down quickly and apparently harmlessly in the environment, plus it was not tainted with the traumatic poisonings that paraquat had become associated with. However, health and safety of paraquat was not an overt concern in this replacement, at least given the marketing of the chemical which was to replace it. Glyphosate was simply better at killing certain common weeds tackled by gardeners. Murphy's promoted glyphosate-based Tumbleweed to amateur gardeners as the 'ultimate weedkiller of the 1980s' and did not define themselves in relation to paraquat. Their glyphosate products were liquid for 'fast mixing and measuring' as well as 'to avoid wastage', a formulation which perhaps benefitted from the Pesticide Advisory Committee's experience of how granules did not necessarily preclude misuse or accidents, especially if such a formulation meant that an amateur product was perceived to be very different to the kind used by professionals. Neither did glyphosate marketing allude to backache; in fact one of the preparations was a gel to be painted on to individual weeds, a laborious if precise application method that certainly involved getting up close with the weed.[[174]](#footnote-174)

At the time of writing, some thirty years after glyphosate's introduction, calls to ban glyphosate had just been heeded in Holland and France, with domestic users no longer being able to buy glyphosate based herbicides for home use. Although anti-glyphosate campaigners decry this as an insignificant drop in the ocean of worldwide use, regulators in these countries highlight reducing children's exposure at home as a key factor behind the new restriction. This time the focus was not acute poisoning, but the slow or delayed lifelong effects of the chemical now understood to be a probable human carcinogen and that may also impact the reproductive system. Glyphosate is intrinsically linked to the demonised multinational chemical company Monsanto, held up as "the" but in reality only one of the numerous manufacturers of glyphosate, though they are the originator of Roundup ready crops, that is to say genetically modified to withstand the herbicide which encourages liberal use of the chemical. Anti-glyphosate campaigners frame their stance in relation to standing up against this corporate entity, which is not something explicitly expressed by parties concerned about paraquat and ICI.

## Conclusions

This chapter has revealed an interesting tension between users and regulators, where users actively circumvented measures that were in place to protect them. With respect to issues of branding, there is not an easily defined pattern. If anything, in discussions about weedkillers branding increasingly became secondary to the active chemical, although chemicals were branded. A large part of this was editorial policy, which undertook a tricky assignment as journalists attempted to avoid product placement in articles while educating readers about using chemicals. This benefitted users when there were many products based on a single chemical as the users should have been able to take this information and make rational, economic choices between products. Early on in this chapter, I showed adverts for Corry's Weed-Death from the 1930s, which was not unusual among herbicides available at the time in that it gave no indication of the active chemical but prioritised its company affiliation. Sodium chlorate was supplied to home gardeners through a number of manufacturers and retailers but never strongly linked to any particular brand when it was promoted, with the chemical name prominently displayed on the product and in adverts long before this was officially regulated. Paraquat was only produced by ICI and officially available to home gardeners branded as Weedol, but paraquat was more recognisable than Weedol or Gramoxone.

Over the course of this chapter, we have seen that gardeners embraced new weedkillers whether they were relatively simple chemicals such as sodium chlorate, or more complex and sophisticated in the case of paraquat, because they reduced the physical work or effort of weeding and freed up time to do other things. The absence of oral history participants who used weedkillers meant that sources in published media and archives had to be heavily relied upon, and only an incomplete picture of the user experience was able to be sketched. A minority of gardeners rejected the specially domesticated Weedol, in favour of the industrial concentrate Gramoxone. While some of this illicit ownership and use of Gramoxone may have been opportunistic, such as when it was taken from work or if offered by an acquaintance, some domestic users sought it out from retailers and circumvented state measures in place to protect them from potentially harmful products. Gardeners could buy and use sodium chlorate either dry or as a liquid, and at a strength of their choosing. Perhaps the behaviours associated with paraquat misuse, were not only related to reluctance or inability to buy the expensive domestic version but to the extremely narrowly prescribed way that Weedol was expected to be used, making it an oppressive, restrictive experience compared to other weedkillers, like sodium chlorate. In designing a separate, quite different domestic product to ensure that the chemical was used safely, the decisions made about formulation and presentation may have pushed some home gardeners into the unsafe behaviours that the manufacturers and Pesticides Advisory Committee wished to avoid.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Ammonium sulphate** | **Sodium chlorate** | **Paraquat** | |
| **Gramoxone** | **Weedol** |
| **Un/branded** | Both | Both | Only branded | |
| **Diff formulations for pro/ amateur?** | ----- | ------ | Pro – concentrated, liquid diluted | Amateur – weaker, granules to be dissolved |
| **Effect on plants** | Fertilise grass / kill broadleaf | Long lasting total weedkiller (kill all) | Used at concentration to kill both broadleaf and grass. Use on seedlings. Deactivated by soil = short term | |
| **Applied** | Dry, by hand or machine | Dry or in solution of users choice of strength | Wet, dedicated equipment, strict instruction, no user choice | |
| **Described as … to people** | ----- | Non poisonous | ----- | Safe |
| **Acute poisoning features** | ----- | Chocolate coloured blood/organs | Corrosive, irritant, affected lungs, kidneys | |
| **Poisoning: Mistaken identity** | ----- | Yes, but rare | Yes, often: dark coloured drinks | ----- |
| **Deliberate ingestion** | ----- | yes | yes | yes |
| **Murder** | ----- | Yes | Yes | ----- |
| **Explosive** | ----- | Yes | ----- | ----- |
| **Introduced** | 1870 | 1930s | 1962 | 1965 |
| **Manufacturers** | Many | Many | ICI or subsidiaries only | |
| **Withdrawn** | ----- | 2009 | 2007 (Britain) | Formulation changed to glyphosate |

Table 2: Summary comparison of the chemicals studied in this chapter

One of the reasons that chemicals were misused in particular ways was through general knowledge, detailed and disseminated in the mainstream media, as well as other cultural and educative endeavours. Bangers made with sodium chlorate were considered something of a rite of passage in the journey to becoming a chemist. Even after sodium chlorate became notorious through its use by terrorists, gardeners do not appear to have been put off using the chemical. They were quite able to understand that the chemical was only dangerous under certain conditions, which were not present in their households.

When considering these chemicals misuse as poisons, it is particularly interesting that sodium chlorate, an allegedly harmless chemical, was used as a poison by humans but this use did not receive media attention so appears to have been relatively unknown. In contrast, despite paraquat not being unusually toxic and far better characterised that sodium chlorate, it quickly gained a sinister reputation as a human poison. While all the deaths from paraquat were regrettable, there was not really anything to distinguish these from other poisonings, apart from the media attention they received.

The ready identification of a single company, ICI, as the source of the paraquat, rather than the numerous companies making sodium chlorate may provide the clue as to why paraquat generated such an uproar. ICI as a multinational corporation provided a convenient target for a limited, but highly voluminous, coverage of the chemical in mainstream media. As a new chemical, far greater detail was known about paraquat's effects and modes of action on plants and animals than for sodium chlorate, which had simply been on the market for longer. Plenty of other chemicals available in the home were decanted into unmarked containers, then accidentally ingested resulting in fatal poisoning, due to the lack of antidote or effective treatment. The fact that paraquat poisoning did not have an antidote, despite barely any other chemicals in everyday use having antidotes, was seized on in otherwise unremarkable, albeit tragic, cases of poisoning.

Indeed, representatives of chemical manufacturers and the committees that assessed product safety expected a minority of people to wilfully misuse any chemical as poison, and focused on directing the correct uses. Irresponsible behaviour, such as putting liquids into unlabelled, reused beverage bottles which led to accidental misuse happened with other household chemical products so had been predicted, but was extremely difficult to prevent through labelling alone, demonstrated by continued cases of mistaken identity following changes to cautionary words on the label.

Through the appropriate selection and application of herbicides, weeding was elevated to a more skilful task than just identification of target plants. Pages of reviews, instructional articles, opinion were printed along with promotional puffery. Domestic users were encouraged by the model users they saw in print and broadcast media to engage with the most up to date methods, but were also reminded that old, relatively simple chemicals such as sodium chlorate remained perfectly good and scientific solutions to certain weed problems. Using herbicides domestically was not explicitly promoted by the manufacturers as modern, and while one of the adverts hinted at the emotional benefit of spending more time with your children when you spent less time on weeding, this tactic was not continued in other adverts. The pressures of modern life, the general sense of squeezed time were not articulated, nor the possibilities of what that extra time could be spent on. This sense of modernity was present in exhortations that the products would save time and ease effort, contributing to a more leisurely form of gardening. As much as I wanted to find evidence for chemical use equating to science and modernity in these adverts, the theme was not present. Instead, tradition and normalcy were promoted.

The price of herbicides raised questions about who was expected to use them, as herbicides are non-essential products which can be replaced by human labour. Their retail price, known by all who saw the packages or advertising, reflected the time and costs that went into the product's development and subsequent approval, as well as marketing, but also worked to limit the availability of the product to a group of users who are able and willing to spend.

The diversity of non-professional situations means that amateur gardeners may not have seen the specially formulated domestic product as relevant for their needs, despite certainly not being a user trained to handle agrochemicals. The process of researching this chapter has suggested that the processes of developing branded products for domestic consumers has been overlooked, probably because of the many archival dead ends, at least at the company end. While the records kept by the Home Office relating to the PSPS and specifically the control of chemicals that turned out to be problematic, have proved to be a rich resource for this historian as they provided evidence of the discussions about the users.

Comparing sodium chlorate and paraquat leads to questions about professional and amateur products. In the case of sodium chlorate, there was no difference save the quantities used by home users and professional users. Despite being a crystalline white solid, it was not involved in many cases of mistaken identity. In the case of paraquat, the radically different versions for different users was not facilitated by the press coverage coordinated by ICI, which focussed on the generic chemical paraquat instead of firmly establishing brand name differences early on. The expense and the obvious difference between the liquid and granular preparations acted to divert domestic users to the professional concentrate stuff, and the tendency of users to decant the dark liquid into drinks bottles put people at risk of accidental ingestion.

Domestic measurements like pinch and saltspoonful are seen less often in the context of garden chemicals than they are with chemicals used inside the house, with greater precision being applied to chemicals for killing, often used by men.

A branded product becoming better known or referred to almost exclusively by its active chemical like this was not an isolated experience. Anaesthetist John Powell wrote of ICI's halothane-based product Fluothane "When I arrived at Catteric Garrison I prided myself on being an anaesthetist with a variety of agents at his fingertips, but by the time I left [3 years later] I was using Fluothane almost to the exclusion of other volatile anaesthetics and was also by this time calling it by its approved name halothane rather than by its trade name."[[175]](#footnote-175) Being on first name terms with a chemical like this indicates familiarity or insider status, bypassing the trade name that others less knowledgable about it might use. It is not the same as nicknames for pharmaceuticals, which tend to be related to their therapeutic class or overall function, rather than the chemical name. However, paraquat obscured the fact that there were different products available to professional and amateur users.

Children have been used in garden chemical advertising to stand in for multiple meanings; that the chemical is easy to use, that it is safe, that using the chemical will allow you to spend more time with your children instead of weeding. Children have proven vulnerable to adult's habit of reusing pop bottles, so their naivety and trust resulted in accidental ingestion and poisoning, but adults have also fallen victim to this inappropriate storage method. Children were not disproportionately accidentally poisoned, and protective changes to formulation were not made only in terms of children, even if newspapers more often carried reports of children's poisonings.

1. Russell, Stan. "Laboratory Gardening." *Practical Gardening*, April 1964, 3. [↑](#footnote-ref-1)
2. Russell, Stan. "Over the Fence." *Practical Gardening*, 1976. p5 [↑](#footnote-ref-2)
3. "Dicksons for Weed-Killer." *Belfast News-Letter*, 23 April 1891, 2.; "Sofnol Advertisement." *Amateur Gardening*, 09 June 1934, xx; "Abol Advertisement." *Amateur Gardening*, 23 June 1934, 1. [↑](#footnote-ref-3)
4. Delap, Lucy. "Housework, Housewives and Domestic Workers: Twentieth-Century Dilemmas of Domesticity." *Home Cultures* 8, no. 2 (2011): 189-210.; Boase, Tessa. *The Housekeeper's Tale*. London: Aurum Press, 2015; Todd, Selina. "Domestic Service and Class Relations in Britain 1900-1950." *Past & Present* 203, no. 1 (2009): 181-204. [↑](#footnote-ref-4)
5. Constantine, S. (1981). Amateur Gardening and Popular Recreation in the 19th and 20th Centuries. *Journal of Social History,* 14(3), 387–406. [↑](#footnote-ref-5)
6. JC Loudon "Suburban Gardener and Willa Companion" quoted in Holmes, Caroline. *New Shoots Old Tips*. London: Frances Lincoln, 2004. p25 [↑](#footnote-ref-6)
7. Roy, Hay. "Say it with Fertiliser." *The Times*  (08 December 1973): 13. [↑](#footnote-ref-7)
8. Strange, Joan, and Christopher McCooey. *Despatches from the Home Front : The War Diaries of Joan Strange, 1939-1945*. Tunbridge Wells, England: JAK Books, 1994. [↑](#footnote-ref-8)
9. Buchan, Ursula. *A Green and Pleasant Land: How England's Gardeners Fought the Second World War*. London: Hutchinson, 2013. [↑](#footnote-ref-9)
10. Glasspoole, Claire. "25 Labour Saving Ideas." *Practical Gardening*, November 1966. p31 [↑](#footnote-ref-10)
11. Church, Roy, and Christine Clark. "Purposive Strategy or Serendipity? Development and Diversification in Three Consumer Product Companies, 1918 - 1939: J & J Colman, Reckitt & Sons and Lever Bros./Unilever." Chap. 3 In *The Emergence of Modern Marketing*, edited by Roy Church and Andrew Godley. London: Frank Cass and Company Ltd, 2003. [↑](#footnote-ref-11)
12. Cousins, Herbert. *The Chemistry of the Garden*. Macmillon Primers. 3rd ed.: Macmillon, 1943. p132 [↑](#footnote-ref-12)
13. Lanman, Susan W. "Colour in the Garden: 'Malignant Magenta'." *Garden History* 28, no. 2 (2000): 209-21. [↑](#footnote-ref-13)
14. Agatha Christie novels containing weedkiller related deaths: The Cornish Mystery 1923, How does your garden grow 1935, Dumb Witness 1937 [↑](#footnote-ref-14)
15. [↑](#footnote-ref-15)
16. Gillespie, Brendan. "British 'Safety Policy' and Pesticides." In *Directing Technology*, edited by Ron Johnston and Philip Gummett, 202-24. London: Croom Helm, 1979. [↑](#footnote-ref-16)
17. Matthews, John. "Unions Press for Herbicide Ban." *New Scientist*, 21 February 1980, 558-. [↑](#footnote-ref-17)
18. Robertson, John Home. "House of Commons Debate 'Herbicide 2,4,5-T'." *Hansard* 980 (1980): cc1544. [↑](#footnote-ref-18)
19. Ashdown, Paddy. "House of Commons Debate "the Advisory Committee"." *Hansard* 81 (1985): cc960-3. [↑](#footnote-ref-19)
20. Gillespie, Brendan. "British 'Safety Policy' and Pesticides." (1979) p209, 211. [↑](#footnote-ref-20)
21. Russell, Stan. "Douse That Bonfire!". *Practical Gardening* 7, no. 2 (May 1966). [↑](#footnote-ref-21)
22. *Handyman Which?*, February 1973, p10 [↑](#footnote-ref-22)
23. *Chemicals for the gardener: for the control of plant pests, diseases and weeds*, MAFF, HMSO 1963 [↑](#footnote-ref-23)
24. “Pesticides and Posterity”, *Horizon*, BBC Television, first aired 30.05.64 (accessed BFI) [↑](#footnote-ref-24)
25. [↑](#footnote-ref-25)
26. Hassall, Kenneth A., and A. V. Percival. *Weed Control in the Home Garden: A Simple Guide*. West Byfleet: Percival, Best, Publications, 1973. [↑](#footnote-ref-26)
27. Ridler, P. "Clearer Labels." *Practical Gardening*, December 1966, 5. [↑](#footnote-ref-27)
28. Rudd, E. "Dosage Chart." *Practical Gardening*, April 1964, 43. [↑](#footnote-ref-28)
29. Reed, F. J. *Lawns and Playing Fields*. London: Faber and Faber, 1950. p119 [↑](#footnote-ref-29)
30. A, Correspondent. "The Lawn in Early Spring." *The Times*  (13 Februrary 1939): 19.; Correspondent, A. "Lawns in Autumn." *The Times*, 1934, 15; Woodhead, Henry K. "Weeds on Lawns." *The Times*, 10 September 1932, 6.; Lloyd, Nathaniel. "Lawns and Putting Greens." *The Times*, 12 March 1933, 10; Russell, E.J. "Turf of Putting Greens." *The Times*, 25 March 1933, 13.; Correspondent, A. "Putting Greens." *The Times*, 19 April 1933, 13. [↑](#footnote-ref-30)
31. "The Care of Lawns." *The Times*  (10 September 1938): 13. [↑](#footnote-ref-31)
32. Hall, A.D. *The Feeding of Crops and Stock: An Introduction to the Science of the Nutrition of Plants and Animals*. London: J. Murray, 1912. p250-251 [↑](#footnote-ref-32)
33. Beeton, Samuel Orchart *The Book of Garden Management*  London: S.O. Beeton, 1870. [↑](#footnote-ref-33)
34. *Irish Gardening* Vol. 4. 1909. Reprint. London: Forgotten Books, 2013. 339-40. [↑](#footnote-ref-34)
35. "Close of the Chelsea Flower Show." *The Times*, 23/05/1913 1913, 6. [↑](#footnote-ref-35)
36. "Success of the Flower Show." *The Times*, 22/05/1914 1914, 5. [↑](#footnote-ref-36)
37. "Lawns and Lawn Sands." *The Times*  (1922/04/22/ 1922): 15. [↑](#footnote-ref-37)
38. Macself, A. J. *Grass: A New and Thoroughly Practical Book on Grass for Ornamental Lawns and All Purposes of Sports and Games*. London: Cecil Palmer, 1924. p101 [↑](#footnote-ref-38)
39. "Lawns and Lawn Sands." *The Times*  (1922/04/22/ 1922): 15. [↑](#footnote-ref-39)
40. Correspondent, A. "The Care of Lawns." *The Times*  (10 September 1938): 13. [↑](#footnote-ref-40)
41. Forum discussion <http://www.gardenbanter.co.uk/united-kingdom/202517-iron-phosphate-kill-moss.html> accessed 01 July 2015 [↑](#footnote-ref-41)
42. Corry&Company. "Advertisements." *Amateur Gardening*  (05 May 1934): xxii. [↑](#footnote-ref-42)
43. Fisons. "Advertisement: Fisons' Fertilisers for Lawns." *The Times*, 17 February 1934, 15. [↑](#footnote-ref-43)
44. GB190804276 (A) 1908-09-10, A distributing device for seeds, fertilisers, lawn sand, weed killer and other solid materials of a similar character; GB191312911 (A) 1914-06-04 A Machine for distributing lawn sand, artificial manures and the like; GB614142 (A) 1948-12-09 Improvements in hand distributors for lawn sands and like substances. [↑](#footnote-ref-44)
45. "The Lawn in Early Spring." *The Times*  (13 February 1939): 19. [↑](#footnote-ref-45)
46. Beale, Reginald. *The Book of the Lawn: A Complete Guide to the Making and Maintenance of Lawns and Greens for All Purposes*. London: Cassell, 1931. [↑](#footnote-ref-46)
47. Macself, 1924. PAGE NO [↑](#footnote-ref-47)
48. Beale, Reginald. *The Book of the Lawn: A Complete Guide to the Making and Maintenance of Lawns and Greens for All Purposes*. London: Cassell, 1931. p81 [↑](#footnote-ref-48)
49. Dawson, R.B. *Lawns*. Amateur Gardening Handbook. London: W.H. & L. Collingridge Ltd, 1954. p63 [↑](#footnote-ref-49)
50. Hellyer, Arthur George. *Your Lawn*. Twickenham: Hamlyn, 1970. p31 [↑](#footnote-ref-50)
51. Evans, Clinton Lorne. *The War on Weeds in the Prairie West: An Environmental History*. University of Calgary Press, 2002, p154 [↑](#footnote-ref-51)
52. Evans, Clinton Lorne. *The War on Weeds in the Prairie West: An Environmental History*. University of Calgary Press, 2002. p157 [↑](#footnote-ref-52)
53. "Corporate Profile: Warren H. Moyer." *Journal of Agricultural and Food Chemistry* 3, no. 4 (1955): 362-63. [↑](#footnote-ref-53)
54. "Garden Notes." *The Times*  (09/07/1932/ 1932): 13. [↑](#footnote-ref-54)
55. Thatcher, T. H. . "Weed Killing on Railways." *The Times*  (19 August 1937): 8. [↑](#footnote-ref-55)
56. "Attractive Allotments and the National Scheme." *National Allotments Journal*, no. 21 (1934): 10-12. [↑](#footnote-ref-56)
57. "A Wonderful Weed-Killer (Continued)." *National Allotments Journal*, no. 23 (1935): 19-21. [↑](#footnote-ref-57)
58. "A Wonderful Weed-Killer (Continued)." *National Allotments Journal*, no. 23 (1935): 19-21. [↑](#footnote-ref-58)
59. "Attractive Allotments and the National Scheme." *National Allotments Journal*, no. 21 (1934): 10-12. [↑](#footnote-ref-59)
60. Reed, Peter. "Making War Work for Industry: The United Alkali Company's Central Laboratory During World War One." *Ambix* 62, no. 1 (2015): 72-93. [↑](#footnote-ref-60)
61. Handlist <http://discovery.nationalarchives.gov.uk/details/rd/110e9ce8-710e-48a7-a46d-d8045328faa3> [↑](#footnote-ref-61)
62. Podger, Hugh. *Albright & Wilson: The Last 50 Years*. Sudley: Brewin Books Ltd, 2002. p15 [↑](#footnote-ref-62)
63. "Staveley's New Venture." *The Daily Mail*, 28 September 1935. p2 [↑](#footnote-ref-63)
64. Watson, James. "The Significance of Mr Richard Buckley's Exploding Trousers: Reflections on an Aspect of Technological Change in New Zealand Dairy Farming between the World Wars." *Agricultural History* 78, no. 3 (2004): 346-60. [↑](#footnote-ref-64)
65. "A Wonderful Weed-Killer." *National Allotments Journal*, no. 22 (1934): p17 [↑](#footnote-ref-65)
66. "Gardening &C." *The Times*, 24 March 1939, p1. [↑](#footnote-ref-66)
67. Display advertising, *The Daily Mail*, 27.04.40. p9 [↑](#footnote-ref-67)
68. Display advertising, *The Daily Mail*, 17.04.54 p6 [↑](#footnote-ref-68)
69. Whitehead, Stanley B. *Garden Weeds and Their Control*. London: J.M. Dent, 1949. p58 [↑](#footnote-ref-69)
70. "Garden Poisoner Injures Baby." *The Daily Mail*, 01 July 1958, 5. [↑](#footnote-ref-70)
71. "A Wonderful Weed-Killer." *National Allotments Journal*, no. 22 (1934): p19 [↑](#footnote-ref-71)
72. A Correspondent. "Weary Battle against the Weeds." *The Times*, 21 March 1959, 9. [↑](#footnote-ref-72)
73. Glasspoole, Claire. "25 Labour Saving Ideas." *Practical Gardening*, November 1966. p31 [↑](#footnote-ref-73)
74. "Garden Poisoner Injures Baby." *The Daily Mail*, 01 July 1958, 5. [↑](#footnote-ref-74)
75. "Police Rule out Cricket Tour Vigilantes." *The Times*, 07 May 1970, 2; "Wrecker Poisons Golf Links." *The Daily Mail*, 25 July 1960 1960, 7. [↑](#footnote-ref-75)
76. [↑](#footnote-ref-76)
77. HO 144/23246 19 March 1941 letter to Dr Watts from Gonne St Clair Pilcher [↑](#footnote-ref-77)
78. HO 144/23246 Ross, J. M. "Letter to HE Watts: Chemicals." 14 Dec; Watts, H. E. "Letter to JM Ross: Chemicals." 17 Dec: National Archives, Kew, 1942. [↑](#footnote-ref-78)
79. IMG\_3090 Letter from chief constable Reading police to the Explosives Department, Home Office [↑](#footnote-ref-79)
80. "Extract from Minutes of Special Branch Conference (Regional) Held at Reading on 29/4/43.".MAFF: HO45/11240 National Archives, Kew, 1943. [↑](#footnote-ref-80)
81. ""Atlacide"." *The Times*  (21 September 1944): 3. [↑](#footnote-ref-81)
82. Hansard: HC Deb 25 October 1944 vol 404 c188W, HC Deb 19 November 1945 vol 416 cc25-6, HC Deb 08 July 1946 vol 425 c11W, HC Deb 05 July 1948 vol 453 cc11-2W, HC Deb 08 July 1948 vol 453 c47W, HC Deb 11 November 1948 vol 457 c1717 [↑](#footnote-ref-82)
83. "Home made explosives (accidents)" HC Deb 28 June 1966 vol 730 cc250-1W [↑](#footnote-ref-83)
84. "The Best Way to Keep Paths Free of Weeds." *The Daily Mail*, 13 June 1959. [↑](#footnote-ref-84)
85. "Sodium chlorate" HC Deb 21 December 1961 vol 651 c178W [↑](#footnote-ref-85)
86. "Sodium Chlorate "HC Deb 07 February 1963 vol 671 cc644-5 [↑](#footnote-ref-86)
87. "May in the Garden with ICI." *The Daily Mail*, 02 May 1970, p9. [↑](#footnote-ref-87)
88. "Sodium Chlorate" HC Deb 07 February 1963 vol 671 cc644-5; "Sodium Chlorate" HC Deb 18 May 1966 vol 728 cc266-7W, [↑](#footnote-ref-88)
89. Health and Executive Safety. 1998 "Storage and Use of Sodium Chlorate and Other Similar Strong Oxidants." p7. [↑](#footnote-ref-89)
90. "Victims Tell of Struggle to Find a Career." *The Daily Mail*, 21 August 1964, 5. [↑](#footnote-ref-90)
91. Boots, Home and Garden. "Special Announcement: Sodium Chlorate." news release, 18 May 1970, 1970. [↑](#footnote-ref-91)
92. British Agrochemicals Association. *Directory of Garden Chemicals*. Third ed. London: British Agrochemicals Association 1978. [↑](#footnote-ref-92)
93. Geraghty, Tony. *The Irish War: The Hidden Conflict between the Ira and British Intelligence*. JHU Press, 1998. p189 [↑](#footnote-ref-93)
94. Rodwell, Robert. "Army Uncovers a Mrs Beeton for Bombers." *New Scientist*, 03.05.1973 1973, 276-77. [↑](#footnote-ref-94)
95. "Revolutionaries and Anarchists Used Bombs against Political Enemies, Prosecution Says." *The Times*  11/11/1971 [↑](#footnote-ref-95)
96. "House of Commons Debate Northern Ireland (Control of Explosives) ". *Hansard* 838 (05 June 1972 1972): cc156-72. [↑](#footnote-ref-96)
97. "House of Lords Debate "Explosives Security"." *Hansard* 365 (06 November 1975): cc1377-9. [↑](#footnote-ref-97)
98. "House of Commons Debate 'Barking (Explosions)'." *Hansard* 977 (22 January 1980): cc206-11. [↑](#footnote-ref-98)
99. "Disaster on the Doorstep." *The Daily Mail*, 27 September 1982, 14-15. [↑](#footnote-ref-99)
100. "Weed-Killer Wife Jailed for Life." *The Daily Mail*, 21 July 1973, 11. [↑](#footnote-ref-100)
101. "Spinster Killed Nosey Old Man - Police." *The Daily Mail*, 03 April 1962, 6. [↑](#footnote-ref-101)
102. "Angry Husband 'Poisoned His Wife's Cereal'." *The Daily Mail*, 16 October 1985, 8. [↑](#footnote-ref-102)
103. Knight, Author R. K., J. R. Trounce, and J. S. Cameron. "Suicidal Chlorate Poisoning Treated with Peritoneal Dialysis." *The British Medical Journal* 3, no. 5565 (1967): 601-02. [↑](#footnote-ref-103)
104. "How I Wooed the Head by Lovelorn Caretaker." *The Daily Mail*, 15 May 1974, 15. [↑](#footnote-ref-104)
105. "Commission Decision Concerning the Non-Inclusion of Chlorate in Annex I to Council Directive 91/414/EEC and the Withdrawal of Authorisations for Plant Protection Products Containing That Substance." *Official Journal of the European Union*  (18 November 2008). [↑](#footnote-ref-105)
106. Haworth, Carl, Alan, and Cleaning and environmental solutions (seller). "Questions & Answers: How Can You Sell Weedkiller Containing Sodium Chlorate When Wholesale of This Was Banned in 2009 & Use of It Since 2010?" [↑](#footnote-ref-106)
107. MAF284/307, 2, PS427 SC 1175, Scientific Subcommittee on Poisonous Substances used in Agriculture and Food Storage, “First Report on Paraquat”, 23.03.62 [↑](#footnote-ref-107)
108. Casey, P., and J.A. Vale. "Deaths from Pesticides Poisoning in England and Wales: 1945 - 1989." *Human & Experimental Toxicology* 13, no. 2 (1994): 95-101. [↑](#footnote-ref-108)
109. Wain, p.139 [↑](#footnote-ref-109)
110. Bates, J.A.R. "First Report on "Weedol" Garden Herbicide."MAF 284/289, National Archives, Kew, 1961. [↑](#footnote-ref-110)
111. MAF 284/307 "Extracts from Minutes: Advisory Committee on Poisonous Substances Used in Agriculture and Food Storage stamped 20/03/62." National Archives, Kew, 1962. [↑](#footnote-ref-111)
112. "Third Report on Paraquat 'Weedol' for Amateur Use." 3: MAF 289/384 National Archives, Kew, March 1964. [↑](#footnote-ref-112)
113. SC 2376 Weedol Co-operator Trials [↑](#footnote-ref-113)
114. "Coroners and the Public Interest." *The British Medical Journal* 3, no. 5927 (1974): 374 [↑](#footnote-ref-114)
115. "Ends the work of weeding" Daily Express, 03.04.65 p14; "My Dad's a Weedol weeder" Daily Mirror, 06.05.67, p21 [↑](#footnote-ref-115)
116. “Information On Poisons” *The British Medical Journal* , Vol. 1, No. 5339 (May 4, 1963), p. 1220 [↑](#footnote-ref-116)
117. Goulding, Roy. "Letter to J.A.R. Bates August 16 1967: Paraquat." National Archives, Kew, MAF 284/307 p104 . [↑](#footnote-ref-117)
118. “Weedkiller Warning”, Peter Bullen, Daily Mail, 25.05.68, p4 [↑](#footnote-ref-118)
119. Swan, A. A. B. "Letter to F. Stewart 13 May 1968." National Archives, Kew. [↑](#footnote-ref-119)
120. Plant Protection Limited. "Sc1174: Gramoxone Data Sheet." MAF 284/307 National Archives, Kew, 1962. [↑](#footnote-ref-120)
121. MAF 284/307, 149, p4 Letter from AAB Swan (Plant Protection Ltd) to F Stuart (Poisons Board) 16.02.68, National Archives, Kew [↑](#footnote-ref-121)
122. MAF 284/307, 149, p3 Letter from AAB Swan (Plant Protection Ltd) to F Stuart (Poisons Board) 16.02.68, National Archives, Kew [↑](#footnote-ref-122)
123. MAF 284/307, 199-201 Letter from CE Rabington (MAFF Regional Safety Inspector) to J Rowe (MAFF Deputy Chief Inspector) giving details of article in *Cambridge Daily News*, 09.11.68 “Label on bottle of weed killer said 'Lemonade'” [↑](#footnote-ref-123)
124. MAF 305/32 Holloway, G. R. "Letter to Bates, 25th October 1968." National Archives, Kew.. [↑](#footnote-ref-124)
125. MAF 305/32 Letter from Stewart, P. to Holloway 30 April 1969 "Paraquat" National Archives, Kew [↑](#footnote-ref-125)
126. “Lung Transplant in Edinburgh”, Glasgow Herald, 17.05.68, p1; “Boy and Girl in lung-swop operation” Daily Mail, 13.05.68 , p1; “Lung boy sits up for icecream”, Daily Mail, 18.05.68, p1; “Lung transplant boy dies” Daily Mail, 29.05.68, p1 [↑](#footnote-ref-126)
127. “Boy with new lung winks at father” The Times, 18.05.68, p10 [↑](#footnote-ref-127)
128. Matthew et al, BMJ Vol 3, no 5621, pp 759-763 759 [↑](#footnote-ref-128)
129. "Paraquat and Diquat Liquid Formulations: Summary of Experience of Human Exposure December 1965 - May 1967." MAF 284/307 National Archives, Kew. [↑](#footnote-ref-129)
130. "Don't waste time with weeds" [↑](#footnote-ref-130)
131. MAF 284/307, 61, Letter from Labrum to Wiseman (PPL) 02 August 1965, National Archives, Kew. [↑](#footnote-ref-131)
132. Holloway, G. R. "Letter to F. Stewart: Paraquat 12 March 1968." National Archives, Kew. [↑](#footnote-ref-132)
133. "Killer chemical goes on Poisons List", Daily Mail, 09.09.68 p6 [↑](#footnote-ref-133)
134. 'Poison death: Firm rapped', Daily Mirror, 31.10.72, p9 [↑](#footnote-ref-134)
135. “Killer chemical goes on Poisons List” Daily Mail 09.09.68, p6 [↑](#footnote-ref-135)
136. “Should this killer be allowed?” DM, 30.08.72, p6 [↑](#footnote-ref-136)
137. Easton, P. H. "Regulations on the Sale of Paraquat."HO305/32: National Archives, Kew, 1973. [↑](#footnote-ref-137)
138. Staples, Gordon. "Letter from Mr Staples to Mr Onslow." 6. In *Control of Paraquat*: National Archives, Kew, 1971. [↑](#footnote-ref-138)
139. “Girl drinks first and dies” Daily Mail, 30.09.72 p9 [↑](#footnote-ref-139)
140. "Now paraquat must carry poison label", Daily Mail, 02.02.74, p11 [↑](#footnote-ref-140)
141. Memo from DA Wrigley, 18.10.72 [↑](#footnote-ref-141)
142. "Paraquat's toll of 97 victims" Daily Express, 13.07.74 (mentions murderer Jennifer Kenyon using a false name) [↑](#footnote-ref-142)
143. HO 305/32, Letter from R Kendall to GR Waters, 22.01.74 [↑](#footnote-ref-143)
144. “Strict controls imposed on paraquat weedkiller” The Times, 02.02.74, p2; “Now paraquat must carry poison label” Daily Mail, 02.02.74 p11. [↑](#footnote-ref-144)
145. MAF 284/307 Bureau of Commercial Research Ltd (Research Division of Erwin Wasey, Ruthrauff and Ryan Ltd). "Report of a Placement Test for Weedol Weedkiller October 1964." National Archives, Kew, 1964. [↑](#footnote-ref-145)
146. Darby, Charles. "How Paradise Found It's View Again." *Daily Mail*, 07 May 1966, p9; "Poison Husband's Grief." *The Daily Mail*, 23 November 1977, 11. [↑](#footnote-ref-146)
147. “Super Summer” Timothy Whites advert, Daily Express, 17.05.68 [↑](#footnote-ref-147)
148. Tomlinson&Hayward. "Advertisement." *Amateur Gardening*, 05 May 1934, 24.; "Sofnol Advertisement." *Amateur Gardening*, 09 June 1934, xx; [↑](#footnote-ref-148)
149. Hilton, Matthew. *Smoking in British Popular Culture, 1800-2000 : Perfect Pleasures*. Studies in Popular Culture. Manchester, UK ; p119 [↑](#footnote-ref-149)
150. Gaskell, Jane. "The Boy Who Thought He'd Had a Drink of Pop." *Daily Mail*, 24 June 1971, 6.; Smith, L.L. "Mechanisms of Paraquat Toxicity in Lung and Its Relevance to Treatment." *Human & Experimental Toxicology* 6, no. 1 (1987): 31-36. [↑](#footnote-ref-150)
151. Howard, p162 [↑](#footnote-ref-151)
152. Kennedy, p.148 [↑](#footnote-ref-152)
153. HO305/32, Extract from minutes of 66th Meeting of the Poisons Board, 23.2.73 [↑](#footnote-ref-153)
154. City of Liverpool Coroners' Depositions, 12 July 1968 in HO 305/32; “Child died from weed killer” The Times, 14.08.68, p2 [↑](#footnote-ref-154)
155. P. Meara, Personal communication, email 28.01.14 [↑](#footnote-ref-155)
156. SW 1169, 182, PNM Moore documenting a telephone conversation with Holloway 26.6.68, National Archives, Kew [↑](#footnote-ref-156)
157. MAF 284/307 Bureau of Commercial Research Ltd (Research Division of Erwin Wasey, Ruthrauff and Ryan Ltd). "Report of a Placement Test for Weedol Weedkiller October 1964." National Archives, Kew, 1964. [↑](#footnote-ref-157)
158. Prosser, Alf. "Growing Prices." *Practical Gardening*, 1980, p7. [↑](#footnote-ref-158)
159. Scientific Subcommittee on Poisonous Substances used in Agriculture and Food Storage. "Extract from Meeting 9th September 1969." National Archives, Kew, 1969. [↑](#footnote-ref-159)
160. Hawkes, Nigel, and Jane Edgington. "Ban This Poison." *The Observer*, 25 March 1973, 44-45. [↑](#footnote-ref-160)
161. Fifth report on paraquat - Home Garden Use, MAF 284 307, doc 108 {IMG\_2917} [↑](#footnote-ref-161)
162. "Medical Record of Weedol Use." In *Poisonous Substances Paraquat*, 5: National Archives, Kew. [↑](#footnote-ref-162)
163. Kendall, R. "Letter to J Harrison from R Kendall." 27 March 1973 HO305/32, National Archives, Kew. [↑](#footnote-ref-163)
164. HO305/32, Extract from minutes of 66th Meeting of the Poisons Board, 23.2.73 [↑](#footnote-ref-164)
165. Meredith, T.J., and J.A. Vale. "Treatment of Paraquat Poisoning in Man: Methods to Prevent Absorption." *Human & Experimental Toxicology* 6, no. 1 (1987): 49-55. [↑](#footnote-ref-165)
166. Hawkes, Nigel, and Jane Edgington. "Ban This Poison." *The Observer*, 25 March 1973, 44-45. [↑](#footnote-ref-166)
167. Howard p147 [↑](#footnote-ref-167)
168. Morpeth, D. H. "Paraquat." HO305/32: National Archives, Kew, 11 October 1972; Kendall, R. "Poisons Board: Paraquat." HO305/32: National Archives, 07 February 1973. [↑](#footnote-ref-168)
169. Farm and Garden Chemicals, HC Deb 20.07.71, vol 821 cc1395-407 [↑](#footnote-ref-169)
170. Price, TH. "Colouring of Liquid Arsenical Weedkillers." National Archives, Kew, 1922. [↑](#footnote-ref-170)
171. Deeweed advert, Daily Mail, 04.07.81, p27 [↑](#footnote-ref-171)
172. McKee, Victoria. "Up the Garden Path?". *The Times*  (28 April 1988): 18.; "ICI advertisement." *The Times*  (06 May 1995): 50[S2]. B&Q advertisement, *The Express* July 25 1998, p30. [↑](#footnote-ref-172)
173. Nick Nuttall, Environment Correspondent. "Weedkiller Linked to Frogs' Decline." *The Times*  (17 January 1996): 6.; Jill, Parkin. "Tidy Gardens That Reap a Terrible Toll." *The Times*  (07 June 1997): 14[S].; "Fatal Weedkiller Kept in Fridge." *The Times*  (09 December 2005): 24.; de Bruxelles, Simon. "Doyenne of Fashion Isabella Blow Died after Drinking Weedkiller." *The Times*, 11 May 2007, 1, 15.

     "Father Dies after Accidentally Drinking from Lucozade Bottle Filled with Weedkiller." *The Daily Mail*, 09 December 2010.; Robbie, Millen. "Chemicals That Poison Our Food." *The Times*  (12 April 2001): 5[S2]. [↑](#footnote-ref-173)
174. Murphy's. "New Tumbleweed Does More Than Any Other Weedkiller." *Practical Gardening*, 1980. [↑](#footnote-ref-174)
175. From "The birth of an industry" gallery, Catalyst Science Centre, Widnes. [↑](#footnote-ref-175)